The Journal of

THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE

Registered at the G.P.O., Sydney, for transmission by post as a periodical.

Editor :
H. J. HYNES, D.Sc.Agr., M.Sc.
Address : Box 3819T, G.P.O., Sydney, N.S.W.

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VOL. 4, No. 3 SEPTEMBER, 1938

The N.S.W. Soil Conservation Bill

Until a few months ago, it was possible for most of us to read with complacent interest of enormous losses of soil in the American " dust bowl ", and of the spectacular effects of water erosion in other parts of the United States. But Australians have now been shocked into the realisation that the devastating forces which have ruined, or are even now attacking a sixth of the area of the United States, are at work here. Wind in the west and water in the eastern areas are stealing our soil. Pasture improvement, crop rotation, improved cultivation and manuring have bolstered up production against the natural drain upon the earth's fertility. But erosion, the greatest depleting agency of all, has worked unhampered. It has even been encouraged by some of the recognised methods of farming, until the damage has become so obvious that the State has been forced to act.

Investigations had been proceeding in New South Wales for about five years, but until the introduction last month of the Soil Conservation Bill public interest had been aroused only spasmodically. It is perhaps unfortunate that we shun the spectacular methods of American publicity for national questions of this kind. A wider and more vigorous public appeal might have saved some of our valuable wheat lands years ago. No doubt some areas were saved through the co-operation of farmers with departmental experts, for the control of water erosion in its early stages is a simple matter. But action on a wider scale needs legislative support and the establishment of an authority to deal with this matter and nothing else. That is what the new Bill will do. It has passed both Houses of Parliament, and will shortly become law. It is the first legislation of its kind in the Commonwealth, and it is to be hoped that it will inspire similar legislation in other States.

The basis of the Bill is co-operation between the landowner and a special Soil Conservation Service. It is not intended to deal with what might be termed normal, geologic erosion, but with the accelerated erosion which is due, largely, to the efforts of man. It is in this sense a measure of insurance against further loss of capital, for the surface soil of a country is its richest asset. It has become the custom in Parliament to attach to each important Bill a short explanatory note. We can do no better than quote the note attached to this Bill for a description of the things it sets out to correct :

" The continued losses of the surface soils of our rural lands as a consequence of erosional action, the depreciation of vast tracts of grazing areas from the same causes, the siltation of water storages, the increasing liability to floods following abnormal run-off through vegetative denudation, the erosion of river banks and associated damage to adjacent lands, demand that a rational soil conservation policy be initiated and vigorously pursued in the interests of every person in the State."

The new Service will thus have a vast field in which to operate. Its first work probably will be a reconnaissance of the damage caused by the erosional forces of wind and water. The areas particularly liable to serious erosion will be indicated, and the landowners concerned will be invited to enter into voluntary agreements with the Service with the object of mitigating erosion. They may receive advances out of moneys provided by Parliament to have the work done. Owners will not be forced to mitigate erosion purely in their own interests. Only when damage originating from an owner's land is causing deterioration of the lands of adjoining owners, or of existing national works, will there be any element of compulsion. At the outset, there was a good deal of apprehension among farmers about this compulsory provision, but fuller discussion, in Parliament and at various farmers' conferences, appears to have satisfied most people that 90 per cent. of the Soil Conservation Service's work will be based on voluntary co-operation. The method to be adopted with private lands is interesting. Section 17 of the Bill States :

"Where the Minister is of opinion that any tract of land is subject to erosion, or is liable or likely to become liable to erosion, and that such tract of land should be notified as an area of erosion hazard, he may, by notification published in the Gazette, and in a newspaper circulating in the locality in which such tract of land is situated, give notice that such tract of land should be notified as an area of erosion hazard."

Owners concerned may then lodge objections, and if these are rejected by the Minister they may appeal to the Land and Valuation Court. When the area has been notified finally, the Director of the Service may be authorised to enter upon any specified land therein and initiate any work considered necessary, but not unless (*a*) the Minister is satisfied that work on the land is necessary to protect other land in the area, (*b*) the owner has neglected or refused to enter into an agreement, and (*c*) the owner has been given notice, against which, again, he may lodge an objection. A further provision empowers the Minister to demand contributions from such an owner towards the cost of the work done on his land, and again there is a right of appeal. Thus the compulsory provisions of the measure appear to be hedged about with adequate safeguards.

The Government has been careful to point out that it would be impossible for the State to carry out anti-erosion work on every farm requiring it. It is intended to limit the main activities in agricultural and grazing lands to districts where requests for assistance originate, and where urgent action is most necessary. Whatever work is done on private properties, according to a Ministerial statement, will be done in districts where the voluntary co-operation of the farmers is assured.

It appears, then, that precept and example will be the two big factors in the work of combating erosion. The need for soil protection is so urgent that the Conservation Service must become almost at once one of the most important of all Government agencies.

Insect Pests and Plant Quarantines

By

J. W. Evans, M.A.,

Department of Agriculture, Hobart.

The greater number of the insect pests at present established in Australia have been brought into the country during the past 150 years, accompanying living plants, foodstuffs, timber and other produce, and, as it is usually estimated that insects, quite apart from their other harmful activities, destroy about ten per cent. of all agricultural produce, the actual monetary value of the crops that have been destroyed by introduced insects must be enormous. To this sum must be added the money that has been spent on control measures.

Thus it is evident that the plant quarantine services of the Commonwealth and the various States are of great importance, and should be well organised, conducted with efficiency and in touch with all scientific developments that concern them. Also, whilst every effort should be made to prevent the advent of new pests, and the dispersal of those already established that have not yet spread to the limits of their available environment, no barriers to trade should be erected unless absolutely essential.

This article is written to draw attention to certain aspects of the present Australian plant quarantine regulations concerned with insects, and to stress the need for some organization capable of ensuring that all regulations are based on the best available scientific knowledge and retained only as long as justified.

Schedules.

Accompanying the plant quarantine regulations of the Commonwealth and the various States are lists of undesirable insects and fungous diseases, usually grouped together under the heading of " The Schedule ". It might be supposed that as far as the Commonwealth regulations are concerned, the insects listed would be those of known economic importance which occur in countries in direct communication with Australia, and which, though not yet established anywhere in the Commonwealth, might well be introduced with imported commodities.

An analysis of the Commonwealth list[1] discloses that it comprises three whole orders of insects, and in addition thirty-five families, eight genera and seventeen species, but the reason for the selection of those listed and the exclusion of others is difficult to understand. Whilst it is not denied that the orders Collembola, Isoptera and Thysanoptera contain a number of injurious species, all insects of these orders are not pests, and other orders occur, such as the Orthoptera, of which no representatives are listed, and which are at

least as important in this respect. Most of the families given contain certain pests, but so do very many others that are omitted, and it is suggested that the possibility is remote of any " wood boring moths " of the family Hepialidæ reaching these shores alive. Likewise with the genera and species. Of the species listed, only one, the Mediterranean Fruit Fly (*Ceratitis capitata*) is already established in Australia, and this is included presumably because it is not yet widespread and of general occurrence. On the other hand, a number of other major pests, such as the Oriental Peach Moth (*Cydia molesta*), are not yet generally distributed in Australia.

An examination of the schedules of the various States is even more mystifying. If it is accepted that the Commonwealth regulations are concerned, with certain exceptions, only with such insects as are not yet introduced into Australia, it might be supposed that each State is concerned with insect pests already in Australia, but not yet established within its own territory, and with those that are established in the State and against which control measures are enforced when needed. It will be sufficient to refer to the schedules of four States in order to show the diverse manner in which these lists are drawn up.

The Tasmanian schedule[2] comprises twenty insect pests, mostly listed under technical names no longer in current use, and includes four distinct types of insects. Some, such as the Rutherglen Bug (*Nysius vinitor*), are indigenous, whilst others, such as the Codling Moth (*Cydia pomonella*), are introduced and well established. A few, such as the Colorado Potato Beetle (*Leptinotarsa decemlineata*), have not yet reached the Commonwealth, whilst one, *Phylloxera vastatrix*, not only does not occur in Tasmania, but is a pest of the vine, which cannot be grown, under Tasmanian conditions, except for ornamental purposes or in exceptional circumstances. There is no differentiation between the various groups, nor any explanation as to why the pests listed have been chosen.

The Victorian list[3] comprises a number of family names apparently chosen at random, and includes a few specific names of established pests, and a number of foreign ones, of which some, such as " *Adoretus umbrosus*, the May-Bug of Hawaii and Japan ", are obscure.

Under the Western Australian regulations,[4] no fruit or plant may be brought into the State infested with the Codling Moth, *Phylloxera*, fruit flies, or scale insects belonging to six genera. This list at least has the virtue of brevity, thus differing from the Queensland schedule,[5] which covers four pages and is in the nature of an index. Its length can best be explained by an example. Scale insects are listed as such, and as Coccidæ, and mealy-bugs have a separate entry. In addition, eight separate species of scale insects are given under both their popular and technical names.

It is apparent that these various schedules are in need of revision, and it is suggested that it would serve a useful purpose if four separate lists were

prepared by each State: the first to comprise those indigenous insects that occur within the boundaries of the State and are considered as pests; the second, established introduced insects; the third, pests already within the Commonwealth but not yet in the particular State, although believed capable of permanent establishment; and the fourth, those insects not in Australia and which are regarded as a potential menace by the State.

Such lists, which would need revision from time to time, would serve as a basis for quarantine regulations, both of the Commonwealth and the States.

Regulations.

To illustrate the unsatisfactory nature of the present methods of crop protection by quarantine regulations, and the need for some central advisory body, three examples are given below with which the writer has been personally concerned. With one, difficulty was experienced in persuading interested public opinion within the State that certain insects generally regarded as a potential menace, and against which quarantine measures were desired, were in actual fact not to be feared. In another instance, where quarantine action was urgently needed to protect the State from a genuine menace, great difficulty was experienced in devising the necessary safeguards. In a third case, certain quarantine regulations of one State adversely affected the trade of a neighbouring State, and caused great and unnecessary expense to the government of still another State.

Fruit Flies.

Available evidence,[6] suggests that neither the Mediterranean Fruit Fly nor the Queensland Fruit Fly (*Chætodacus tryoni*) could ever become permanently established in Tasmania as serious pests of any of the fruits grown in the State. Yet these insects are more dreaded by Tasmanian apple growers than are any others established on the mainland of Australia, and until recently every orange imported into the State from States in which these flies are established had to be examined separately by inspectors searching for fruit fly larvæ. If the wishes of the apple-growing community were put into effect, drastic quarantine measures would be promulgated against citrus and other fruits grown in Queensland and New South Wales. Fortunately, all that the regulations at present in force require is that fruit suspected of being infested must be quarantined, and if later found to contain maggots, must be destroyed or removed to a jam factory.

Oriental Peach Moth.

The Oriental Peach Moth does not yet occur in Tasmania, but as it is believed that the Tasmanian climate would be favourable to this insect, and as it has proved difficult to control the pest elsewhere, it was decided that only by total prohibition of the importation of peaches and nectarines from those

States in which this insect is known to occur could any safeguard be obtained. This decision was supported by the knowledge that similar regulations are in force in certain Canadian and American States. In addition, evidence was available that fruit which was not certified as originating from districts free from Oriental Peach Moth, was being landed on the wharf at Launceston in such a condition that not only were larvæ present in the cases, but pupæ were found attached to several of the peaches examined.

Accordingly a proclamation was gazetted in July, 1937, giving effect to total prohibition of the import of peaches and nectarines from the States of New South Wales and Victoria.

Some few months later, a request that the proclamation be withdrawn was received from Victoria, on the grounds that it differed in no material aspect from a Victorian proclamation which prohibited the importation into Victoria of Tasmanian potatoes and which was declared invalid by the high court as infringing section 92 of the Commonwealth Constitution. It may be mentioned that the particular Victorian proclamation referred to was concerned with a potato disease known as Powdery Scab (*Spongospora subterranea*), which is to be found on occasion wherever conditions are favourable for its development.[10].

The proclamation was accordingly withdrawn and replaced by a demand for two certificates to be given with respect of fruit intended for export to Tasmania. The certificates were of such a nature that virtual prohibition was secured. The volume of trade affected is negligible, as of recent years less than 1,000 bushels of peaches have been imported annually into Tasmania.

If a State has no powers to pass legislation to protect itself from an insect pest that occurs in neighbouring States, when such legislation entails the total prohibition of the import of a commodity, then the question arises whether similar Commonwealth regulations are valid, such as those that prohibit the removal into the State of Western Australia of apples, pears or quinces from any other part of the Commonwealth on account of the Codling Moth. Further, should legislation of this nature be the function of the Commonwealth, or of the States immediately concerned ?

Lucerne Flea.

In 1930, following the introduction of the Lucerne Flea into Tasmania from a South Australian source, an attempt was made by the Tasmanian Department of Agriculture to eradicate the pest by means of lime-sulphur sprays applied to all known infestations several times each season. In 1934, the New South Wales Government, fearing that the pest might be introduced into that State with soil around potatoes, issued a proclamation prohibiting the import of plants grown within a five-mile radius of land upon which the Lucerne Flea existed or had existed in the past, unless the whole of the land

within the area had been adequately inspected between certain dates. By this time it was realised in Tasmania that eradication was impossible, but in order to protect the potato export trade, spraying was continued.

In 1938, it was brought to the notice of the New South Wales authorities that there was little likelihood of potatoes carrying eggs of the pest, that there were no areas in New South Wales liable to heavy infestations, since the climate was unsuitable, and that in those districts where permanent establishment was possible the flea already occurred and was widespread. Accordingly the proclamation was amended. However, during the preceding years the Victorian potato trade has been affected, some £40,000 had been spent by the Tasmanian Government on control measures, and it had become necessary to infringe a basic principle of insect control, since though it may be the duty of a government to bear the expense involved in an attempt to eradicate a newly introduced pest, for obvious reasons it should never be its function to bear the total cost of controlling a well established pest.

Some Aspects of Foreign Plant Quarantine Measures.

California.—A few years ago, a bulletin was published by the University of California[7] which consisted of the report of a committee set up for the purpose of inquiring into efficacy and economic effect of plant quarantines in California. In this bulletin, the various basic quarantine problems are considered from all aspects, and each insect regarded as a potential menace to Californian agriculture is discussed separately under the following headings: geographic distribution, hosts, life history and habits, economic importance, adaptability to the California environment, methods of dispersal and avenues of entrance, and efficacy and necessity for quarantines.

Two findings of the committee need especial prominence in Australia, firstly: " Plant quarantines should never be used for any purpose other than the exclusion of pests and disease "; secondly, " If the major usefulness of a quarantine has passed, or if it becomes evident that it is no longer effective, it should be promptly rescinded ".

The last paragraph of the bulletin consists of the following recommendation: " The Committee believes that it would be desirable for Congress to enact legislation providing that interstate quarantines promulgated by States be subject to review and possible disapproval by the Federal Secretary of Agriculture. This would prevent retaliatory, unfair or otherwise unjustifiable State quarantines, which are likely to cause trouble in the future."

Canada.—In the writer's opinion the system by which plant quarantine regulations are drafted in Canada is admirable. Instead of each State making such regulations as it may see fit, a Destructive Insect and Pest Act Board[8] has been constituted " for the purpose of co-ordinating opinion and effort with regard to the administration of the regulations under the Destructive Insect

and Pest Act, and to recommend to the department any changes in the said regulations which may be considered advisable in the public interest ".

The Board consists of five members, the Dominion Entomologist, the Dominion Botanist, the Director of the Experimental Farms, the Chief of the Division of Foreign Pests Suppression and the Deputy Minister of Agriculture. The actual regulations[9] are a model of clarity and conciseness, and are of two sorts : foreign regulations and domestic regulations. An example of one of the latter is as follows : *Regulation No.* 6 (*Domestic*) 1*st Revision.*—" The importation into the province of British Columbia of all fresh peaches and peach nursery stock, including fruit seeds for propagating purposes, is prohibited from the province of Ontario ". *Explanation of Regulation.*—" The regulation was passed to prevent the introduction of the Oriental Fruit Moth (*Laspeyresia molesta*) and Peach Yellows into the province of British Columbia, as neither this pest nor the disease has been found in the said province ".

Suggestions.

On a number of occasions in the past[10, 11] attention has been drawn to the unsatisfactory nature of certain Australian plant quarantine regulations, and at a conference of ministers of Agriculture held at Hobart in February, 1934, the following item was on the agenda :

" *Item* 50. Question of the advisability of constituting a plant quarantine advisory council. (N.S.W.)." Reference to the " Summary of Decisions " supplies the information that Item 50 was dealt with in conjunction with Item 49, which was : " Consideration of the action necessary to minimise the risk of introducing plant diseases per medium of imported seed (N.S.W. and Tasmania) ", and the decision was : " Resolved to adopt the recommendation of the Permanent Heads Committee ". (*Appendix A.*) The appropriate paragraph in Appendix A informs one that, " The Committee recommends that action should be taken to prevent the introduction of plant diseases per medium of imported seed, and that in order to secure the most effective control the Federal authorities should consult the State Departments of Agriculture as to the methods to be adopted ".

No mention is made of the matter of a plant quarantine advisory council, and under " Summary of Action Taken " one reads that " Representations were made to the Commonwealth Government, and advice has been received that the Director of Health considers that much information relative to seed trade and vegetable production should be collected before regulatory measures are attempted ". Evidently no action was taken in respect of Item 49.

Whilst the need for a central advisory body on plant quarantine matters clearly exists, many difficulties must be met before such a body is possible.

Australia is in a different position from both Canada and the United States in lacking a Federal Department of Agriculture, and it is appreciated that each

State has certain, though apparently limited, powers of jurisdiction within its own borders, which powers might not willingly be foregone.

It is suggested that the matter is one in which the Institute of Agricultural Science might well take some interest as a body, and move that the whole question of a plant quarantine advisory council be considered by those in authority. At the same time it should be made clear that representation on such a body should consist of fully qualified technical officers, who by virtue of their scientific training and experience are in the best position to provide the advisory service which is still so urgently required.

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Butter Flavour and Quality

By

Edwin G. Pont, M.Sc.Agr.,

Biological Branch, Department of Agriculture, Sydney.

The flavour and aroma of butter are the principal factors upon which its quality and commercial value depend. Control of the physical condition of butter is more or less a mechanical function, and it has been developed to such an extent in modern dairy practice that serious faults or variations in butter texture are rarely encountered. On the other hand, butter flavour and aroma are determined by such a subtle complex of biological, biochemical and chemical reactions that it is not surprising that these characteristics should exhibit wide diversity and variability.

The various factors, including the economic, associated with butter flavour can only be fully comprehended against a background of the essential considerations involved in the manufacture and marketing of a high class uniform product. It is proposed, therefore, to give an account of the scientific and technical problems associated with butter manufacture and storage, and to discuss their relationship with flavour and quality.

The Use of Starter in Butter Making.

Generally speaking, two distinct types of butter may be produced—a full flavoured, high acid butter prepared with the use of a starter containing flavour- and aroma-producing bacteria, and a mild or even flavourless product which is low in acid or may be slightly alkaline and in which no starter has been used. The first type is produced to the exclusion of all others by Denmark and many Continental countries. From the viewpoint of public taste and demand, it is often accepted as a standard of comparison and in Great Britain may command from 15/- to 30/- per cwt. over the comparatively flavourless, non-starter product. It has very poor keeping quality, however, and rapidly deteriorates after a few weeks even under the best of storage conditions.

Non-starter butter is produced almost entirely in Australia and New Zealand, and, to some extent, in other British dominions and the U.S.A. To the palate accustomed to the fully flavoured product, it appears flavourless or even flat in character. It possesses the advantage, however, of excellent keeping quality and can be allowed to remain in cold storage for long periods without serious deterioration in quality. Between these two extremes, butter may be produced with varying intensities of flavour, depending largely upon the extent to which starter has been used in its manufacture. The fullness of flavour, however, is practically always inversely correlated with its ability to keep in cold storage.

Butter Starters.

In the manufacture of starter butter, the cream, which is usually sweet, is pasteurised and the starter added. The starter is actually a milk culture of selected organisms developing in a form of symbiotic relationship. The characteristic organism in the culture is usually *Streptococcus cremoris*, though *S. lactis* may be and frequently is present. These typical lactic acid streptococci are responsible for the fermentation which converts the lactose of the milk almost entirely to lactic acid. Growing in association with them is a group of bacteria, known by Orla Jensen's classification as betacocci, but more generally referred to as *S. citrovorous* and *S. paracitrovorous*. These organisms, in association with the lactic acid streptococci, bring about a complex fermentation of which the characteristic products are lactic acid, CO_2, acetyl methyl carbinol, diacetyl, acetic acid and small quantities of other organic acids. Acetyl methyl carbinol or acetoin is a product of many bacterial fermentations. It is a reduction product of the diketone diacetyl, and is readily converted to it by oxidation. The diacetyl content of starters is greatly increased by the addition of citric acid, and it is believed that it is derived in the starter from the citric acid liberated through the formation of lactic acid by *S. cremoris* and *S. lactis*.

The Relationship between Diacetyl and Butter Flavour.

Although the use of selected cultures for inducing souring or ripening of cream was general in Denmark in 1895, and spontaneously soured milk and cream had been used as natural starters for a long period before that, diacetyl was not detected in butter starters until 1928, when Schmalfuss[3] first demonstrated its presence. The researches of van Niel, Kluyver and Derx in 1929[4] showed that the actual characteristic aroma and flavour of butter, or at least a substantial part of it, was due to the presence of this compound diacetyl. Although investigations have been hampered by the very small amount of diacetyl normally present in butter and the difficulty of estimating it quantitatively, the results of the latter workers have on the whole been substantiated, and it is now generally agreed that the intensity of flavour and aroma varies with the actual diacetyl content of the butter.

If a full flavoured butter is required, after being pasteurised and inoculated with the starter the cream is held for some time at a temperature favourable for the development of the acid- and flavour-producing organisms. In the case of a mild flavoured butter, the actual development of the starter in the cream is not permitted, or only to a small extent, and the resultant flavour is largely derived from that preformed in the starter. Where full development of the starter is permitted in the cream, it is probable that the flavouring element exists mainly in the form of the carbinol owing to the low oxidation-reduction potential of the lactic acid fermentation.

The Development of Flavour in Butter.

During the process of churning, the incorporation of air in the cream combined with the mechanical effect of concussion brings about a condition in which the fat globules coalesce, forming granules or "grains". A large amount of the buttermilk is liberated as a free liquid, while a smaller quantity is locked up in the fat in the form of small, finely dispersed globules. The free buttermilk is washed away as much as possible, and with it goes a considerable proportion (about four-fifths) of the diacetyl+acetoin. During the salting and working process, the buttermilk globules become even more finely dispersed through the butter, and additional moisture droplets containing chiefly water and salt are incorporated. The buttermilk globules contain organisms derived from the original starter, casein, lactose, the products derived from the fermentations initiated by the starter, oxygen absorbed during the churning process and, in some cases, salt.

The full flavour of starter butter does not develop until about 24 hours after churning. That this is largely a biological process is evidenced by the failure of the flavour to develop if the butter is held at freezing point or lower. Barnicoat[1] a New Zealand investigator, assumes that this flavour development is due to the conversion of acetoin to diacetyl by a dehydrogenating effect of the starter organisms or their enzymes. There is also believed to be a direct chemical effect resulting in the conversion of acetoin to diacetyl. (Davies.[2]) The free lactic acid in the buttermilk is known to attack directly the butter fat with which it is in immediate contact. This results in the liberation of oleic acid which, by virtue of being unsaturated, forms peroxides, these compounds oxidising the acetoin in the buttermilk droplets to diacetyl.

The Deterioration of Starter Butter.

Unfortunately, the series of auto-oxidative reactions initiated by the presence of an acid butter serum does not cease at this point. The peroxides formed as the result of the liberation of oleic acid oxidise diacetyl itself to flavourless compounds, and lecithin which is concentrated at the fat/water interfaces in the butter also becomes involved. The breaking down of lecithin in this way leads to the production of fishy flavour, a fault to which all high acid butters are prone in storage. The butter fat itself is then oxidised, causing stale and tallowy flavours.

Auto-oxidation in this manner is greatly hastened in the presence of catalysts. Diacetyl itself with its capacity for easy oxidation and reduction may serve to activate oxygen in butter. The presence of heavy metals, of which copper and iron are the chief examples, is known greatly to stimulate oxidative processes. These metals are usually dissolved in acid cream by contact with bare copper and rusty iron surfaces. In the form of proteinates, they become concentrated at the fat/water interfaces in both cream and butter,

and in this position their catalytic activities have full extent. Strong light also may act as a catalyst to fat oxidation.

Non-Starter Butter.

The essential factor involved in the deterioration of starter butter is the acidity accompanying the production of diacetyl and acetyl methyl carbinol in the cream. Manufacturing processes in Australia have developed along a line which has followed the reduction of cream acidity to as low a level as possible consistent with other considerations concerned with flavour. Most Australian cream, particularly during the summer, is well ripened by spontaneous souring when delivered at the factory. Actually this cream is reduced in acidity to a point lower than that normally found in fresh cream. In New South Wales, between 0·05 per cent. and 0·1 per cent. acidity calculated as lactic acid is the point aimed at in neutralisation at the present time. The serum of the resultant butter is slightly alkaline, about pH 7·4 being the most common value found. After neutralisation the cream is pasteurised, usually by the " flash " method, though a process known as vacreation, in which the cream is heated in a vacuum, is being increasingly adopted. Vacreation and other deodorising processes are very efficient in the general renovation of cream and the reduction of weed and feed flavours. After chilling and allowing to stand overnight, the cream is churned without further treatment.

No data for the diacetyl or acetoin content of Australian butters appear to be available. Barnicoat[1] gives up to 0·05 p.p.m. for New Zealand sweet cream butter, but it is probable that figures for Australian butter would tend to be higher than this owing to the amount preformed in the naturally ripened cream. This is consistent with the belief common in Australia that a better flavoured butter can be produced from a well ripened than a sweet cream, although it is pasteurised and reduced to the same level of acidity.

The Flavour of Australian Butter.

At this point it is well to point out that while diacetyl is undoubtedly the chief flavouring constituent in butter, it is not the only one. If this were not so, sweet cream butter would be practically tasteless, but this is far from being the case. Actually butter fat itself contributes to the taste, and traces of esters like ethyl caproate, butyrate and lactate help to give even a diacetyl-free butter a certain amount of flavour and character.

There are good reasons for believing that the progressive reduction in acidity in Australian butter has been accompanied by a corresponding increase in mildness or flatness of flavour due, seemingly, to the failure of diacetyl to develop in the butter in the absence of an acid serum. Although keeping quality has improved as a consequence, there are some indications that the

point to which flavour can be reduced and still comply with public taste has already been reached, if not exceeded. According to Moir,* for instance, pH values of the serum of New Zealand butter have tended in recent years to drop from slightly alkaline to a level of about neutrality.

Possible Methods of Improving Flavour.

In view of the fairly definite establishment, however, of neutrality as the lowest limit of butter serum consistent with good keeping quality, any method of increasing flavour which involves a reduction of the serum reaction below this point is contraindicated. The use of starters containing only the flavour-producing betacocci has been tried experimentally in England, and found to be unsatisfactory owing to the erratic behaviour of the cultures in the absence of the lactic acid streptococci. The production of a synthetic flavour by the actual addition of diacetyl to the cream naturally suggests itself. This procedure would undoubtedly conflict with the pure food regulations of most countries, however, and the difficulties of thoroughly distributing the very small amounts of diacetyl necessary through a large bulk of cream are in practice considerable. The use of steam distillates from starters might possibly be open to the same objections, but this method—experimentally at any rate—has met with some degree of success. The method most generally used for improving flavour without lowering the acidity of the butter serum is the practice, common in some countries, of adding a well developed starter culture to the cream and then churning without allowing further development of the organisms. This practice is still open to some objection, however, from the viewpoint of its effect on keeping quality. The serum reaction of the butter is lowered only slightly as a consequence, but large numbers of active starter organisms are incorporated in the butter. Although their effects in butter in cold storage are not well understood, deterioration at temperatures above freezing point could be expected to be rapid compared with that in a bacteria-free butter. In view of the fact, however, that diacetyl in itself, in the concentrations usually found in butter, does not appear actively to promote deterioration, there is no fundamental inconsistency in the idea of a moderately flavoured product with good keeping quality. If such a procedure were considered desirable, there is no real reason for believing that the flavour of our butter could not be intensified without affecting its other desirable qualities.

In Great Britain, the disparity in price between Dominion and Danish butter has tended to decrease in recent years. While this has been due to some extent to an education of public taste, it has been largely brought about by better marketing methods, better keeping quality, the elimination of flavour defects and the greater degree of uniformity in character. It is probable that on the English market a butter with a well balanced, characteristic " dairy "

* Personal communication to author.

flavour would always command a substantial premium over the milder product. In view of the fact that the bulk of Australian butter is now exported, and that we are now actually producing for the English to a greater extent than for the home market, this point is undoubtedly worthy of consideration.

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Agricultural Developments in the United Kingdom

Notes from address by Professor R. D. Watt to the N.S.W. Branch of the Institute on August 12, 1938, based on a recent trip abroad.

A statement was recently made by a member of the British Cabinet to the effect that the production from the land industries of the United Kingdom was greater than that from Australia and New Zeaalnd put together. Now New Zealand is rather larger in area than the United Kingdom, and has a somewhat similar rainfall. Australia is 25 times the size of the U.K., and it would be possible to place the latter into that part of New South Wales where the annual rainfall is 20 inches or over. It is therefore surprising, at first sight, to find that production from the land in Britain should be comparable with the total production of Australia and New Zealand.

Many factors contribute to this. One is the steadiness and reliability of the rainfall. Against that, however, is the long five or six months' winter with its attendant drawbacks.

In regard to live stock, sheep in the U.K. number only about a quarter of the total for Australia, and the wool value per sheep is nothing like so high. Yet the total production per sheep is considerably higher in the U.K. because of the high percentage of good quality fat lambs produced. The number of cattle in Australia is approximately $13\frac{1}{2}$ million, as compared with nine million in the U.K. The number of dairy cattle in our own land is considerably less than in the U.K., while the production per head is also much less. The average cow in the U.K. gives about twice as much milk as the average cow in Australia.

Cereal Production.

About 150 million bushels of wheat are produced in Australia annually, which is little more than double the amount grown in the U.K. (66 million bushels), where the areas are small and scattered. The yield per acre, however, is much higher—36 bushels as compared with 12 in Australia.

In the U.K. there is a larger acreage under oats than under wheat, and from this crop the average yield per acre is also about three times that in Australia—45 bushels as against 15. Oats is the second most important single crop in Australia, yet Scotland alone produces 2½ times the total amount produced in the whole of our continent.

Then the very much larger population in the U.K. requires the growth of large areas of vegetables which yield a high value per acre. Glasshouse culture is widely practised, and it is common to see whole fields given over to the cultivation of small fruits like raspberries, strawberries, currants, gooseberries, etc.

The main difference between production from the land in Australia and in the U.K. is that in the latter it is characteristically intensive, whereas in Australia it is relatively extensive. Another factor is that nearly every farmer in the Old Country is a mixed farmer—his work being not only more intensive, but more diversified. The British farmer depends on a small area giving as high a return as can possibly be obtained from it as the result of attention to the most minute details. It is not uncommon to find the source of income on a single farm to be wheat, oats, barley, potatoes, wool, fat cattle and lambs, poultry, eggs, pigs and even the cricket bat willow near a stream.

Another point of note is that there is little or no depreciation of fertility in British agriculture. On a well managed farm, there is, in fact, a gain in fertility, brought about by the use of farmyard manure applied regularly in addition to fertilizers. The soil is enriched indirectly by the consumption of large quantities of imported foodstuffs for live stock, such as linseed cake, soybean cake, etc.

Agriculture Protected and Subsidised.

One very definite change since my last visit is the extent to which agriculture in Britain is now protected and subsidised, largely as a result of the closing of European markets. In times gone by, the British farmer received no government assistance of any kind. He was forced to compete with wheat, butter, bacon and eggs sent from any other part of the world. Britain has now been forced into protecting some of her industries like wheat and sugar. The beet sugar industry is uneconomic, but it is thought wise to preserve it, partly from the employment point of view, but largely because it provides an essential commodity in times of war.

The subsidy for fat cattle varies with the grade of cattle, and also with the source of origin—home bred cattle receiving the highest subsidy. The liming of land, draining of land, and the use of basic slag on pasture are all subsidised, and constitute a considerable aid to economic production.

Breeds of Livestock.

In regard to horses, the Clydesdale is still pre-eminent in Scotland, while the Shire is most widely used in England, although quite a few of the Suffolk Punch and Percheron breeds are to be seen. As a result of showyard judging, there is still a tendency in breeding Clydesdales to aim too much at fineness of bone and quality at the expense of substance. Show points, such as extreme length and slope of pastern, are being emphasised, and the growth of hair over the front of the hooves is being encouraged unnecessarily.

In beef cattle, the Aberdeen Angus appears to be gaining in popularity at the expense of the Shorthorn. In dairy cattle, the Ayrshire still holds supreme place in Scotland, and the dairy Shorthorn in England. The Jersey, Guernsey and Devon breeds are more in evidence in the south-west. The British Friesian, which is more symmetrical in body than that in U.S.A. or on the Continent, has gained very considerably in popularity.

There are something like 36 different breeds of sheep, all suited to the different districts in which they are found. The so-called " half-bred " which has really become a distinct breed, evolved from the Border Leicester and the Cheviot, is pre-eminent in most districts as the mother of the fat lamb. The Border Leicester still holds sway in the colder districts as the male parent, but is gradually being replaced by the Suffolk, which is early maturing and has better hindquarters. Unfortunately, the Border Leicester appears to be degenerating somewhat because of the emphasis on show points—too much attention being paid to a long neck with a high carriage of the head and a very prominent Roman nose, and not enough to the hindquarters. In the south, the Southdown is very popular.

Agricultural Implements.

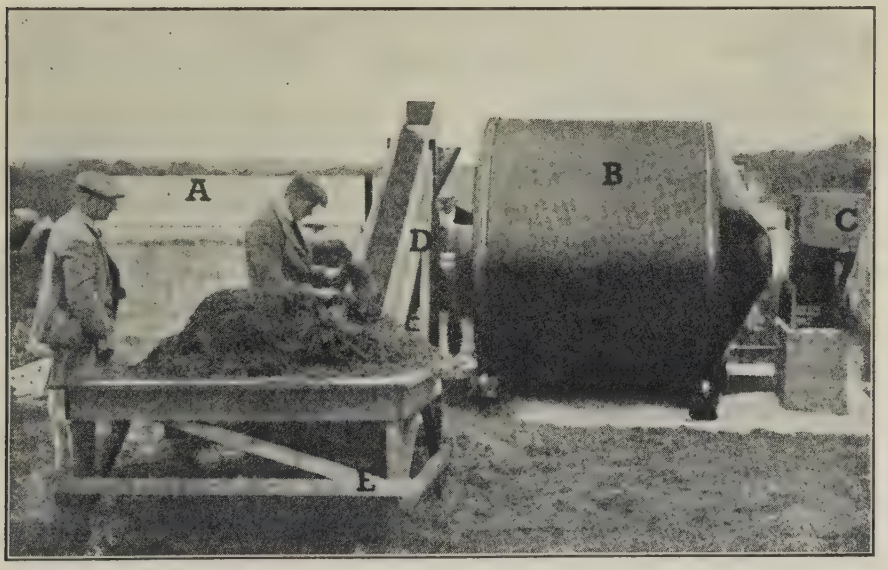
There is a noteworthy general improvement in agricultural implements in Britain. The tractor is now much more extensively used than previously, although very few farms depend on it entirely—using it mainly in rush times. It was interesting to observe in some of the eastern counties the use of tractors with 4-furrow ploughs and wide harrows, cultivators, seed drills and headers, similar to those employed in Australia.

Another development is the gyro tiller of which various types are available. One model inspected was propelled by a diesel oil engine, with gyro tillers driven from the engine, and it does the work very efficiently. The soil is stirred by knives which revolve in a circular manner in a horizontal plane and

pulverise the whole soil to a depth of 15 inches, without bringing the subsoil to the surface. This implement might prove of value in our sugar cane areas.

Two other interesting features were (1) the extent to which rubber tyres are used on vehicles—even the ordinary farm cart and wheelbarrow—experiments having shown that on soft land they mean a saving of 50 per cent. in power, and (2) the greater use of electricity on most farms where, in some cases, farmers generate their own power.

The electric fence, examples of which are now to be seen in Australia, is an interesting example of a new method of application of electricity. Light posts are distributed at intervals with a single barbed wire through which passes the electric current. The fence is not suitable for sheep unless two wires are employed, as owing to their wool they do not come in contact with the wire



A Grass Drier.
A, Brick furnace. B, Rotary drums. C, Fan. D, Conveyor. E, Feed table.

but for cattle, horses and pigs it is reported to be quite effective. One of the reasons given against the recommendations for rotational grazing in Australia is the expense of subdivision fences, but the electric fence would probably prove quite useful in this respect, as it is relatively cheap and running costs are low.

Dried Grass.

The British farmer incurs great expense in the purchase of foodstuffs for livestock, and if Britain could produce more concentrates, a most useful purpose would be served. Dried grass is being utilised with this end in view

It is quite different from hay in many respects. If the grass is grown to a height of four or five inches on good soil, and well manured, it has a much higher value for feeding purposes than when mature. There is very little fibre in it, and the percentage of protein and mineral matter is high, its feeding value being almost equivalent to that of a concentrate. Very successful machinery for cutting and collecting the young grass has been developed, and various types of drying machines are available. The grass is usually passed by means of a long conveyor through a chamber at a temperature of 260°-300° C., and the moisture removed. The treated grass is then pressed into bales or cakes. To obtain the best results, the grass must be specially grown and cut correctly ; not every kind of grass is suitable. A new type of drier, recently patented, is said to be a great improvement on the older types, both in efficiency and price (less than £300), and this may give a great fillip to the process.

Artificial Wool.

Some time was spent at the Wool Secretariat, where Dr. Clunies Ross and others are doing extremely valuable work both in regard to propaganda and the encouragement of wool research. Samples of artificial wool were inspected, and these appeared quite attractive. All fibres were the same length and diameter, and they had a crimp very like the crimp in wool, with a roughened surface. A suit length was also on show, and this had the appearance of a fine, woollen worsted, but actually it contained 50 per cent. wool and 50 per cent. artificial wool.

I do not regard so-called artificial wool as a substitute for, but rather as a supplement to, wool. Even as a supplement, however, it might considerably decrease the demand for pure wool. A garment made solely from artificial wool has not the properties of a woollen garment in appearance, elasticity, warmth, etc. It can be mixed with wool in proportions of 20, 30, or 40 per cent., without any serious deterioration in appearance, but it has not the same wearing qualities. In Germany, it is largely used for civilian clothing, but it is significant that there the soldiers' uniforms are still usually made of pure wool or, if any artificial wool is used for them, it is only in a small proportion. As a supplement, artificial wool is more satisfactory than cotton or rayon. It is some little consolation to our graziers to know that the best type of wool for blending with artificial wool is merino.

The Spectrograph in Relation to Agricultural Problems.

By

A. C. Oertel, M.Sc.,

Division of Soils, Council for Scientific and Industrial Research, stationed at the Waite Agricultural Research Institute.

Introduction.

It appears to be well established that at least some of the minor components of soils are essential for normal growth of plants. Such elements as copper, zinc, boron and manganese are required by certain plants in definite though minute amounts for the completion of their vegetative cycle. It has thus become necessary to develop and perfect methods of analysis for the estimation of these elements in extremely small quantities both in soils and in plant ashes. Purely chemical methods are often satisfactory for the determination of one element alone. These prove tedious, however, when determinations of several minor components are required, and may be inapplicable when limited samples are available. Again, it would be an enormous task to determine by chemical analysis all the metallic elements that might be present to the extent of one part per hundred thousand or more in a small sample. The task becomes almost impossible where differences in the content of all metallic elements are required on a range of samples ; and it is in connection with such problems that the spectrograph offers material scope.

Spectrographic Analysis.

Modern methods of chemical analysis by the spectroscope or the spectrograph depend, like the flame tests for the alkali metals, on the fact that each element, when suitably excited, emits a unique radiation. Compounds containing sodium, for instance, when placed in a hot flame, emit a characteristic yellow light which, if analysed by a prism, is found to consist of certain fixed wavelengths. The same set of wavelengths is emitted by no other element ; and consequently the presence of sodium, or any other metal, can be detected with certainty in a given source of radiation.

The many disadvantages of the flame method has led to the use of the electric arc and the condensed electric spark for the exciting of samples. Their mode of use depends on the nature of the sample ; in the present connection only those methods applicable to plant ashes and soils will be discussed. Solid samples are placed in a small hole drilled in an end of one of the graphite or copper electrodes of the arc or spark gap. The other electrode, the upper one, is usually pointed. When the arc is struck the sample is volatilised by the intense heat, and the vapour conducts the current across the gap. The light

emitted by the arc or spark consists of radiations emitted by all the metallic components of the vapour in the arc or spark gap.

Solutions are put in a suitable supporting vessel, which forms the lower electrode of the spark gap, while a rod of graphite usually serves as the upper electrode. As with the solid sample, the solution is vaporised ; and the light emitted by the spark consists of radiations emitted by all the metallic components of the vapour in the spark gap.

The light from the source passes into the spectrograph, where it is analysed into the component wavelengths, and the resulting spectrum is photographed. A spectrograph differs from the more widely known spectroscope in that the eye-piece of the latter is replaced by a photographic plate. The spectrogram obtained in this way contains a number of lines, each line corresponding to a definite wavelength. Once all the wavelengths have been determined, reference to tables would give the elements which emit those wavelengths. Such a method tends to be extremely tedious, especially with a complex spectrogram. It so happens that as the concentration of an element in a sample decreases, the number of lines due to it, as recorded in a spectrogram, also decreases ; and at the lowest concentrations at which the element can be detected only one or two lines due to that element are recorded. These lines are called, among other names, the " ultimate lines ".

A spectrographer who deals mainly with plant ashes and soils soon becomes quite familiar with the lines due to the main components, and learns the positions of the ultimate lines of the more common minor components with reference to the known lines of the major components. Instead of having to measure the wavelengths denoted by each line in the spectrogram, he can tell by visual inspection alone, in most cases, which elements are present in the sample as minor components in amounts large enough to be detected.

When the amount of an element in a sample decreases, both the number of lines due to it and the intensities of these lines decrease. The latter is the basis of quantitative spectrographic analysis. In addition, the intensity of a line depends on several other factors, such as the current in the arc, the time of exposure of the plate, and the method of developing the plate. If those factors are kept constant, the intensity of a line serves as a basis for quantitative determinations.

One of the most satisfactory methods is to prepare synthetically a number of plant ashes or soils containing known and varying amounts of the minor components. Spectrograms of these synthetic samples are obtained under the standardised conditions adopted. By comparing a spectrogram of a sample for analysis with the standard spectrograms in regard, say, to the intensity of a line due to copper, a value for the concentration of copper in the sample may be obtained.

It will be seen that it is no more difficult to determine quantitatively a dozen minor components than to determine one. The smallest concentration

which can be detected depends on the element in question ; and in the case of a plant ash, when the concentration is referred to " dry matter ", it also depends on the percentage of ash. Assuming a 10 per cent. ash, copper, silver, and several other elements can be detected and estimated in amounts as low as 0·1 to 0·5 part per million of dry matter. The element zinc cannot be detected in amounts less than about 50 parts per million of dry matter, while phosphorus has escaped detection when the amount was about 1 part per thousand, or approximately 1 per cent. of the ash. Most of the metals can be detected in amounts between 0·1 and 10 parts per million of dry matter, while the metalloids are difficult to detect at low concentrations.

Application to Some Agricultural Problems.

A problem presented quite often to an analyst is to determine the difference, if any, in the mineral content of two samples of plant material, one healthy and one diseased. The problem could be undertaken by a spectrographer as follows : Both samples are ashed under identical conditions, and spectrograms of the two ashes obtained under standardised conditions. By comparing the two spectrograms, line by line, one soon detects any difference in the intensities of two corresponding lines. When such a difference is discovered, the element to which that line is due is determined, if not already known from experience.

Although this may appear a simple means of investigating suspected mineral deficiencies, many difficulties present themselves. Even in two samples of healthy plants, numerous differences of a large order may be detected. In one of two samples of healthy pine needles, the writer detected about 5 parts per million of tin, while none was detected in the other sample. In one of two samples of healthy oats, about 10 parts per million of molybdenum were detected, while none was detected in the other sample. If one knew, as one does in some cases, the quantities of each element required for healthy plant growth, the problem would be comparatively simple. When a mineral deficiency is suspected, no one element is usually selected. The only method that seems to be suitable is the quantitative determination of each detectable element, followed by an attempt to discover one which is consistently present in the healthy samples in an amount above a certain limit, and in the diseased samples in an amount below that limit. This involves, of course, the analysis of a large number of samples ; but the spectrograph offers some chance of success, while the task would be almost impossible by ordinary chemical methods.

It is obvious that toxic effects due to minerals present a similar problem.

In soil analyses, one usual advantage of the spectrographic method becomes a disadvantage. A sample of from 10 to 50 milligrammes is required, and it is necessary to stress the difficulty of obtaining a uniform and repre-

sentative soil sample of this quantity. It may be mentioned, however, that an analysis of the original soil is not often required. A sufficiently representative sample of a soil may be extracted by various solvents, and a small quantity of the homogeneous extract analysed.

A spectrographic analysis of a soil or a soil extract has the advantage that a complete survey of the composition is secured (within the limits imposed by the varied sensitivity of the method). One may detect, as a matter of routine, the presence of uncommon elements which may be of great improtance later on. But perhaps the greatest advantage lies in the filed spectrogram itself, which gives a permanent record of the composition of the sample. At some future date, one may desire to know if a certain sample, which has since proved difficult to obtain, contained, say, germanium, and, if so, how much. It is simply necessary in such a case to refer to the filed spectrogram.

The few examples mentioned above indicate that the spectrograph may assist considerably in solving some of the problems of agricultural workers. As yet, it has been applied to a very limited field.

Organic Matter of Soil as Determined by Climate.

By

G. W. Leeper, M.Sc.,
University of Melbourne.

The purpose of this article is to draw attention to a simple treatment of the relation between the amount of organic matter in a soil and the rates at which it is accumulated or destroyed in various climates.

Jenny, in 1930, used American analyses to show that the total nitrogen in the top eight inches of soil increases with increasing rainfall where temperature is constant, and decreases with increasing temperature where humidity is constant. Using the Meyer ratio (H) as an index of effective rainfall, he obtained a good agreement with the formula :

$$N = 0 \cdot 55 e^{-0 \cdot 08T} \ (1 - e^{-0 \cdot 005H})$$

Australian figures also show that nitrogen—and hence the total organic matter of the soil—is correlated with effective rainfall (Prescott, 1931, pp. 42-4).

Jenny based his theoretical work on two factors : firstly, the increased decomposition by bacteria at higher temperatures, given by $e^{-0 \cdot 08T}$; secondly, the increased synthesis by plants under heavier rainfall, given by $(1 - e^{-0 \cdot 005H})$. Apparently, however, he did not consider the effect of both rainfall and temperature on both synthesis and destruction. The amount of organic matter depends on these four factors, not only the two mentioned above. It appears that Nikiforoff (1937) was the first to give the formula :

$$\text{Amount of organic matter } (S) \text{ per acre} = A(1 - r)/r$$

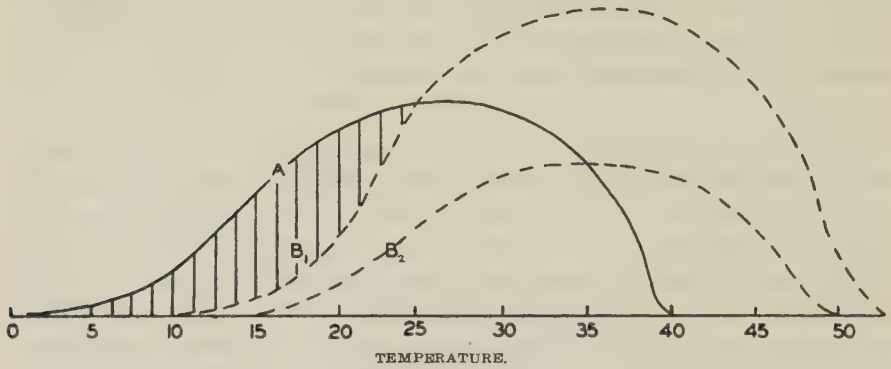
where A = net annual amount of organic matter gained from atmospheric CO_2 by plants (assimilation minus respiration), to which we should add that gained by autotrophic bacteria ; and r = proportion of the total organic matter lost in one year through microbial oxidation to CO_2. All three variables A, r and S are different functions of climate.

In fact this formula may be simplified. It is obvious that when a soil has reached equilibrium with its environment, the amount of organic matter added during a year (A) equals the amount oxidized to CO_2 ; but this latter must be $S.r$. That is, A equals $S.r$, or $S = A/r$. This formula is very similar to Nikiforoff's, as r is small. Both formulæ involve the assumption that in any one soil the microbial activity is proportional to the organic matter. This is not correct (Jensen, 1936), but may be taken as a first approximation.

If we neglect organic matter below the first foot of soil, and assume that an acre-foot of soil weighs 2,000 tons, then for a soil in a relatively moist district, such as southern Victoria, we might have :

Organic matter S=2% of the soil=40 tons per acre.
Annual addition A=1 ton.
Hence r=2·5 per cent.

The amount of organic matter in a relatively dry district, such as northern Victoria, is about one-half the above figure. The explanation commonly given for this low figure is that " the humus is rapidly burned up in the hot climate ". But it seems improbable that r should be higher in the interior (with its hot dry summer during which little bacterial decomposition can take place) than in Gippsland (with a maximum of rainfall during the spring when temperatures are high enough for vigorous bacterial activity). It seems far more likely that the longer growing season of the coastal country gives it twice as high a value



Essential Features of Mohr's Diagram Relating to Organic Matter.
Curves represent—A, Synthesis by plants. B_1, Destruction by aerobic bacteria. B_2, Destruction by anaerobic bacteria. The shaded portion indicates conditions favourable for " accumulation ".

Note.—The curve A represents units which are totally different from those of B_1 and B_2. The fact that A and B_1 happen to intersect at 25 degrees rather than 15 or 35 has, therefore, no significance. The diagram does, however, illustrate the fact that organic matter accumulates especially at low temperatures and in swamps.

for A as a soil in the semi-arid country. Two soils developed in completely different climates may still have the same total organic matter, so long as each increase in A is associated with a proportional increase in r. The value for r is, of course, an average which is made up of high rates during favourable periods of moisture in the warmer months, lower rates during the winter when temperature is low, and very low rates during dry periods in the summer and autumn. Nikiforoff gives figures for a Russian chernozem showing a very high figure for S (440 tons) and a correspondingly low value for r (below 1%). This combination of a normal value for A with a very low value for r has not been satisfactorily explained.

Anaerobic organisms (Mohr, 1930) do not decompose organic matter rapidly until the temperature reaches 30° C. Hence the value of r in swamps is low, and since A remains normal, S is high. Even in places that are not definitely swampy, the same effect is seen in very wet climates. Richness in phosphorus also appears to lead to a high value for S, this time because A is increased more than r.

It is curious that the formula $S=A/r$ has not been more widely used. Discussing total organic matter, Lundegardh (1931, p. 179) says: "In the tropics . . . decomposition proceeds . . . more rapidly than the formation of new organic material". Mohr (1930, pp. 15-16) produces a useful diagram (reproduced in this article) showing the way in which plant growth, aerobic decomposition, and anaerobic decomposition depend on temperature, and states: "Above 25° C. destruction takes place faster than formation". Waksman (1936, p. 257) quotes Mohr with approval, while reproducing the diagram with an unfortunate error in the key. The only possible meaning of such statements is that there is a negative amount of humus present in tropical soils. This confusion is probably due to the impression that the curves A and B (see figure) are commensurable. In any case, many virgin soils in the tropics contain quite respectable amounts of organic matter (3% or more).

The above principles make it possible to estimate the limiting value to which organic matter will tend in any given rotation, such as wheat-fallow or wheat-pasture-fallow. If the contribution of autotrophic bacteria is neglected, the diminution in the first year of bare fallow is A, and the residue after this year is $A(1-r)/r$. Hence the residue after n successive years of fallow should be $A(1-r)^n/r$. Again, since the average annual addition of organic matter in a crop-fallow rotation is $\frac{1}{2}A'$ (where A' in this case is the total yield of the crop, minus that removed in harvesting), the amount of organic matter to which a soil approaches as a downward limit should be $A'/2r$. In the southern wheat belt, in areas where the stubble is burnt, assuming r to be 2·5 per cent., this should make the limiting figure twenty times the average weight of the roots per acre.

The reader will probably perceive crudities in the above arguments; however, the purpose of presenting them is to arouse interest in a point of view which has received little attention from agricultural scientists.

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The Effect of Leaf-Rust on Yield and Baking Quality of Wheat.

By

I. F. Phipps, Ph.D., M.Sc., B.Agr.Sc.,
Waite Agricultural Research Institute, S.A.

Wheat in Australia is affected by two species of rust, *Puccinia graminis* Pers. (stem rust) and *P. triticina* Erikss. (leaf rust). Of these, leaf rust is the more universally distributed, and occurs in epidemic form most frequently, but it does not reduce yield by readily observable quantities, and consequently its effects are usually considered to be negligible. The results presented in this paper indicate that the loss in yield of grain due to leaf-rust infection may, at times, be considerable.

The results of a number of workers have shown that leaf rust is capable of reducing yield.[1–7]. The reported losses in susceptible varieties range from 8-28 per cent. in field trials, and up to 94 per cent. under glass-house conditions.

The experimental work described herein was designed to provide preliminary technical experience in 1937, prior to a more extensive trial in the following season. The results obtained, however, were sufficiently conclusive to warrant publication. Furthermore, an unusual combination of conditions, involving a dry ripening period, severe natural infection with leaf rust and the virtual absence of stem rust infection as a complicating factor, rendered the trial to some extent unique, as it is doubtful whether such conditions could be obtained again in a single, selected year.

Technique.

Two adjacent drill strips, one of Ranee, a susceptible variety, and the other an unnamed crossbred (Gluyas × Hope) resistant to stem rust and leaf rust, were each divided into 20 plots, 8 × 8 links in size. Rust was controlled by spraying with colloidal sulphur (1/500) plus Agral as a spreader at the rate of one-half gallon of spray per plot.

The experiment consisted of four applications of five treatments arranged in randomised blocks. The treatments were as follow:

A. Unsprayed.
B. Sprayed, Oct. 2, 6, 15, 20, 26; Nov. 6, 10.
C. Sprayed, Oct. 26; Nov. 6, 10.
D. Unsprayed.
E. Sprayed, Oct. 2, 6, 15, 20.

Treatments C and D were designed to give normal infection with leaf rust, with the complete control of stem rust in treatment C and its partial control in

treatment D. Since stem rust did not appear to any extent, treatment D remained unsprayed and the sprayings given in treatment C were ineffective. Leaf rust developed to approximately the same extent on treatments A, C and D. These treatments will be referred to as unsprayed, and treatments B and E, in which leaf rust was controlled, as sprayed.

Results.

An estimated infection with leaf rust of 10 per cent. and 85 per cent. appeared on the sprayed and unsprayed plots respectively of Ranee wheat. The foliage of the sprayed plots retained its green colour longer, and the straw ripened more normally than that of the unsprayed plots. Retention of colour was particularly apparent with the upper leaves, while the stem nodes remained green after the internodes has changed colour, where sprayed, but not where unsprayed.

The resistant variety, Gluyas × Hope, was practically free from leaf rust in both sprayed and unsprayed plots. Stem rust appeared on the unsprayed plots of Ranee after flowering, but to the extent of less than one per cent.

TABLE I.

Showing the Effect of Leaf Rust Infection on Yield, 100 Grain Weight, Bushel Weight, Nitrogen Content and Loaf Volume of Wheat.

	Treatment Totals or Means of Four Replicates.					Treatment Effects Significant at.	Difference for Significance.
	A.	B.	C.	D.	E.		
Ranee :							
Total yield (gms.) ..	2842·0	3347·0	2817·0	2915·0	3343·0	0·01	185·0
Yield (bushels/acre) ..	40·8	48·1	40·5	41·9	48·0		
Weight of 100 grains (gms.)	2·83	3·07	2·91	2·75	3·15	0·01	0·11
Bushel weight (lbs.) ..	60·29	61·79	60·60	60·50	61·53	0·01	0·64
Nitrogen content (%) ..	2·675	2·888	2·683	2·660	2·850	0·01	0·12
Loaf volume—							
(a)	490·0	600·0	550·0	490·0	555·0		
(b)	680·0	715·0	620·0	620·0	700·0		
Leaf Rust (%)	85·0	10·0	85·0	85·0	10·0		
Gluyas × Hope :							
Total Yield (gms.) ..	3137·0	3183·0	3061·0	3265·0	3221·0	Not	Sig.
Yield (bushels/acre) ..	45·1	45·7	44·0	46·9	46·2		

(a) Standard bake on bulked samples of four replicates.
(b) Nymalt improver added.

The difference in yield between the sprayed and unsprayed treatment totals of the resistant variety, Gluyas × Hope, is small, and is not statistically significant. Treatment mean square is not significant at the 5 per cent. point. It is assumed, therefore, that the yield differences in the Ranee plots are due to the control of leaf rust and not to a physiological effect of the sulphur spray.

Plots of the susceptible variety, Ranee, sprayed to control leaf rust (treatments B and E) yielded 48·1 and 48·0 bushels per acre, whereas the plots in which leaf rust was not controlled (treatments A, C and D) yielded

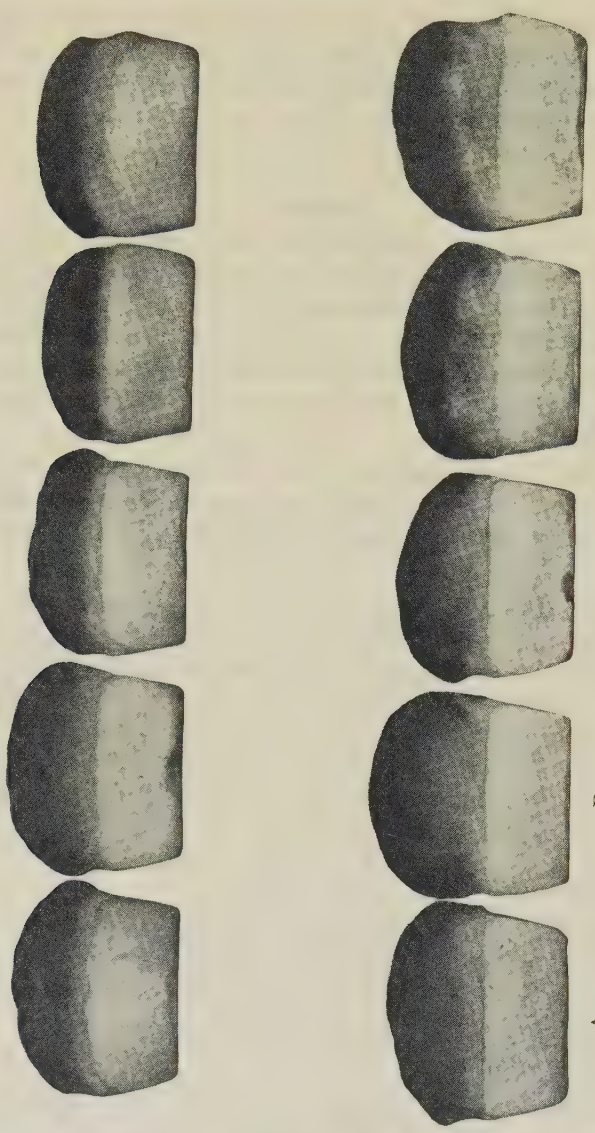

Fig. 1.—Loaves of bread baked from the grain of each treatment. Treatments B and D sprayed to control leaf rust, and treatments A, C and D unsprayed.
Upper row : Standard bake.
Lower row : Nymalt improver added.

40·8, 40·5 and 41·9 bushels. The larger treatment differences are statistically significant. The average difference between sprayed and unsprayed treatments is approximately seven bushels per acre, or a reduction in yield of 14·5 per cent., due to leaf rust infection.

Part of this reduction can be accounted for by a reduction of 8 per cent. in the average weight of individual grains. The remainder is doubtless due to a reduced number of grains per head.

The nitrogen content of samples of grain from individual plots was determined, and is expressed as a percentage of dry weight in Table I. Treatments B and E show significantly higher values than treatments A, C and D. The average difference between sprayed and unsprayed treatments is 0·196 per cent. nitrogen.

Bulked samples of the four replicates of each treatment were milled in an experimental mill and subjected to a baking test by Messrs. Breakwell and Hutton, of Roseworthy Agricultural College, who reported that doughs from flour of treatments B and E were slightly firmer to handle and were slower to develop than those from the other treatments. Treatments B and E also showed a distinct lack of gassing power with a long fermentation, but gave better loaf volumes, both with the short dough and with the addition of a commercial improver. Loaf volume measurements for the standard bake show an average of 578 c.c. for treatments B and E, and 510 c.c. for treatments A, C and D. When Nymalt improver was added, loaf volumes were 708 c.c. and 640 c.c. respectively. Photographs of the experimental loaves are shown in Fig. I.

Summary.

In a study of the effect of leaf rust on yield and other characteristics of wheat, in which leaf rust was controlled by spraying with colloidal sulphur, it has been shown that severe infection reduced the yield of a susceptible variety (Ranee) by 14·5 per cent., reduced the bushel weight of the grain by 1·2 pounds, and reduced the average weight of individual grains by 8 per cent.

Spraying with colloidal sulphur had no measurable effect on the yield of the resistant strain (Gluyas × Hope).

Leaf rust infection reduced the nitrogen content of the grain of the susceptible variety from an average of 2·869 per cent. to 2·673 per cent.

Experimental loaves baked from samples of Ranee wheat under treatment showed an average reduction in loaf volume from 578 c.c. to 510 c.c. for the standard bake, and from 708 c.c. to 640 c.c. when Nymalt improver was added.

Acknowledgments.

Grateful acknowledgment is here made to Mr. H. P. C. Gallus for the nitrogen analyses, Messrs. E. J. Breakwell and E. M. Hutton, of Roseworthy College, for the baking results, and to Mr. S. R. Hockley for technical assistance.

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TECHNICAL NOTES

A CONTINUOUS STILL FOR PRODUCTION OF METAL-FREE WATER.

In the determination of small quantities of metals by micro-chemical methods, considerable difficulty is often experienced in obtaining a continuous supply of water of a sufficiently high degree of purity for the work.

It has been found that ordinary distilled water from a laboratory still contains up to 0·44 p.p.m. of copper, and as this quantity is excessive when working with some biological materials, it was considered desirable to fit up an apparatus which would fulfil the following requirements :

(1) Its operation must be continuous and require a minimum of attention.

(2) It must work from a closed system of supply.

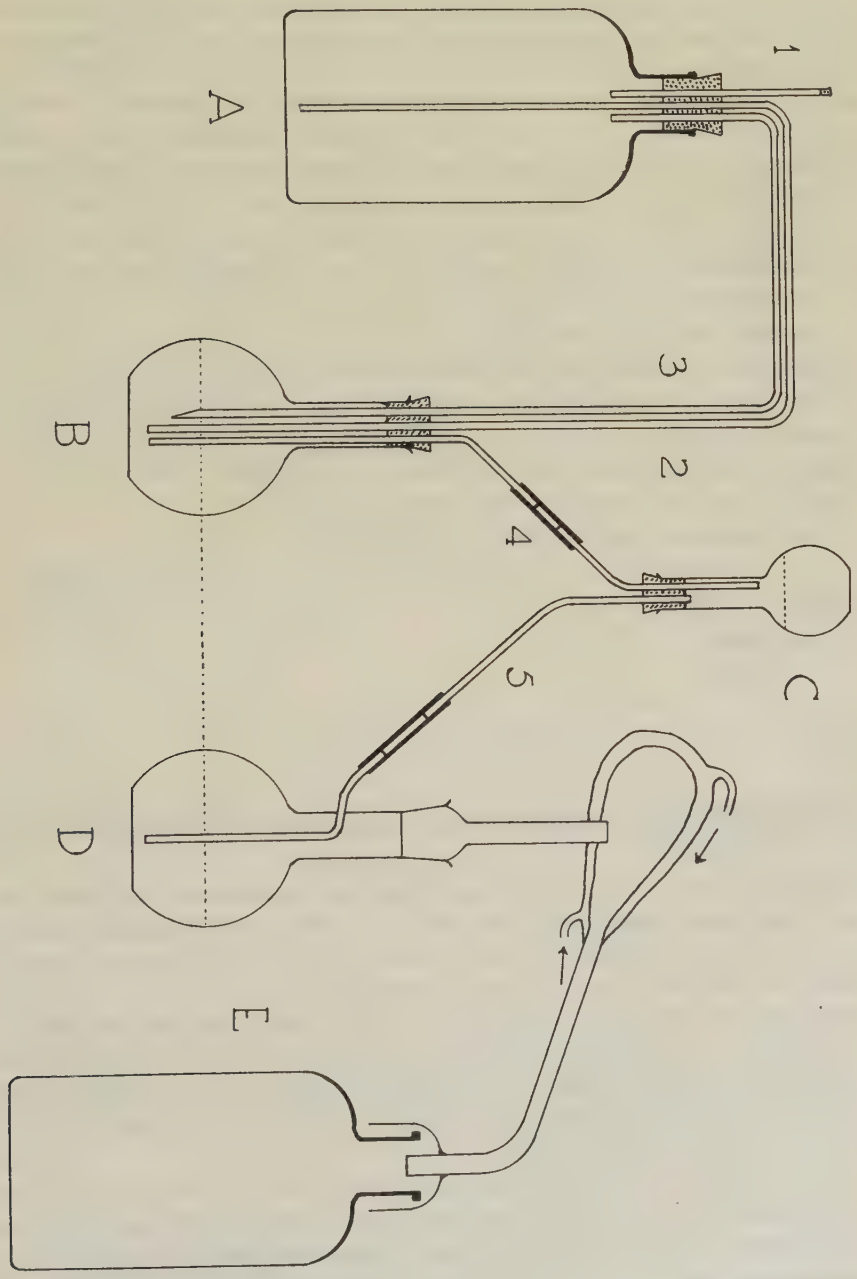
(3) Owing to the possibility of contamination from atmospheric dust, the apparatus must not require frequent dismantling.

(4) The product must be of sufficient purity for micro-chemical estimations.

The apparatus described below consists essentially of a large storage reservoir which supplies water to the distillation unit through an intermediate constant level flask.

The storage reservoir marked " A " in the diagram is so placed that the bottom is above the water in flask " B ", which water is maintained at a constant level by means of a siphon. The reservoir is fitted with an airtight rubber stopper through which pass three glass tubes. That marked 1 is a short tube which is used to start the siphon, and when in operation must be closed at the outer end with a rubber plug. Tube 2, which is the siphon arm for the water, reaches almost to the bottom of the reservoir " A ", and almost to the bottom of the flask " B ". Tube 3 regulates the quantity of water which passes from the storage vessel into the constant level flask " B ". This tube passes just through the stopper in the storage reservoir, and the other end is adjusted to the level of water required in the constant level flask. This tube must be of sufficient internal diameter to allow air bubbles to move readily up the tube through the water column, and the end in flask " B " should be cut obliquely to overcome surface tension effects. A tube of 6 m.m. internal diameter has been found suitable for this purpose. These two tubes (Nos. 2 and 3) fit loosely through the stopper in flask " B ", to facilitate removal when the storage reservoir is replenished. To ensure that flask " B " is open to the atmosphere, an air vent is cut in the stopper.

The second section of the apparatus consists of a siphon, the purpose of which is to maintain water in the boiling flask " D " at the same level as that in the constant level flask " B ". An inverted flask " C " is interposed in this siphon to check the flow of water when back siphoning takes place.


A
B
C
D
E
1
2
3
4
5

The tubes in the inverted flask are so arranged that tube 4, from the constant level flask, passes through the stopper and up to the base of the neck of the inverted flask, whilst tube 5, connecting with the boiling flask, passes just through the rubber stopper. Sufficient water is placed in the inverted flask so that when the system is in equilibrium the level of water is above the top of tube 4. When " back siphoning " takes place, the expansion of air in the inverted flask forces the water below the level of this tube, thereby breaking the siphon and allowing the system to return to equilibrium.

It was found that a 250 ml. flask containing 65 ml. of water gave satisfactory results, but the correct quantity can only be determined by observation and adjustment.

To start the siphon, the required amount of water is placed in flask " C ", the flask set in position, and air drawn through the boiling flask " D ".

The all-glass distillation unit employed was a one-litre Jena Duran glass distillation flask, fitted with a side arm and pear-shaped condenser. To prevent an unnecessary concentration of impurities in the boiling flask, water from a laboratory still was used for distillation.

This apparatus has a capacity of $3\frac{1}{2}$ litres per day.

J. R. Fisher.

Chemist's Branch,
Department of Agriculture,
Sydney.

A SUGGESTED FIELD TEST FOR RESIDUAL SODIUM CHLORATE IN SOILS.

The fact that " trace " amounts of sodium chlorate may remain in soils which have been treated with this weedicide, and may be a cause of lowered productivity for a considerable time, makes it desirable to ascertain prior to sowing whether sufficient chlorate still remains in a soil to affect adversely germination and growth. Cashmore and Carn[1] found that sodium chlorate, when applied at the rate of 200 lbs. per acre, had an injurious effect on the establishment of wheat sown six months later, and that when applied at the rate of 150 lbs. per acre, there was a definite reduction of soil productivity as measured by the yield of grain.

Similar observations have been made in Canada and elsewhere in regard to the persistence of sodium chlorate in the soil and its subsequent effect on crop growth. Decomposition of the salt is rapid apparently in moist soils at temperatures above 20° C., but, on the contrary, is comparatively slow in dry soils.

The use of a plant indicator method such as that described by Loomis *et al.*,[2] in which the observed striping of the leaves and stunting of the growth of maize seedlings are used as an index of the chlorate toxicity of a soil, is necessarily slow, while the ordinary analytical methods for determining residual amounts of the weedicide are somewhat elaborate and could not, of course, be carried out in the field.

During work recently carried out at the Chemist's Branch, N.S.W. Department of Agriculture, dealing with the determination of residual amounts of sodium chlorate in soils following the use of this substance in the control of Skeleton Weed (*Chondrilla juncea*), a simple test for the detection of small amounts of the weedicide in soils was developed. The test referred to is based upon a sensitive reaction employed by Korenman [3] for the detection of chlorates, and consists in observing the rate of fading of a solution of indigo-carmine and sulphurous acid, which takes place when chlorate ions are present in the system in varying concentrations.

Nitrates in the amounts in which they commonly occur in soils were found not to interfere with the test, and as little as two parts of sodium chlorate per million of the soil could be detected by means of it.

It was considered that the test might be adapted for the detection of chlorates in the field prior to sowing, and the following reagents and equipment are suggested for this purpose:

Reagents.

"A"—*Acid indigo solution*—prepared by dissolving 0·02 gramme of indigo carmine in 200 c.c. water, and adding 100 c.c. hydrochloric acid (sp. gr., 1·16).

"B"—*Sodium sulphite solution*—prepared by dissolving 40 grammes of sodium sulphite ($Na_2So_37H_2O$) in 100 c.c. water.

NOTE.—For convenience, the bottle containing this reagent ("B") should be equipped with a dropping tube marked to deliver 2 c.c.

Equipment.

Filter tunnel (3 inches diameter) and filter papers.

Small wooden or metal container capable of holding 20 grammes of soil.

A 4-ounce narrow-mouthed stoppered shaking bottle with 50 c.c. mark.

Two 2-ounce narrow-mouthed stoppered bottles with 20 c.c. and 40 c.c. marks.

Method of Conducting the Test.

Obtain a composite sample of the soil by taking slices of it with a spade, from different holes in the paddock, in the usual way. Thoroughly mix the soil on a piece of bagging or paper, allow to air dry, and take about 2 lbs. of

the mixed soil for the actual field sample. Fill the wooden or metal container with the soil sample, collected as above, and transfer by means of a piece of glazed paper to the shaking bottle, which has been previously filled with water to its 50 c.c. mark. Shake the contents of the bottle at intervals during a period of ten minutes, and filter into the 2-ounce sample bottle until the filtrate in the latter reaches the 20 c.c. mark.

Add the acid indigo solution (reagent " A ") until the 40 c.c. mark on the sample bottle is reached, and then 2 c.c. of the sodium sulphite solution by means of the dropping tube. Insert the stopper in the bottle ; shake the contents well, and note the time required for the blue colour to disappear.

The time required is approximately proportional to the amount of sodium chlorate in the soil extract.

From the work carried out, it is considered that the approximate amounts of sodium chlorate present in a soil and expressed as p.p.m. correspond to the undermentioned times required for fading of the indigo-carmine solution under the conditions specified in the test. The probable effect of these amounts of residual chlorate on the sown crop is also given in the table below.

—	Time.	Parts per Million.	Condition of Soil and Probable Effect on Crop.
Decolorised in ..	30 seconds or less.	20 or more.	Moderately to strongly affected—impaired germination likely.
Decolorised in ..	2 minutes.	10	Moderately affected—leaf striping and retarded growth likely.
Decolorised in ..	6 minutes.	5	Lightly affected—probably no effect on crop.
Not decolorised in	10 minutes.	0	Non-affected—no effect on crop.

M. S. Benjamin.

Chemist's Branch,
Department of Agriculture,
Sydney.

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UNPOISONED BAITS FOR REDUCING POPULATIONS OF BANANA BEETLE BORER (Cosmopolites sordidus).

The use of unpoisoned baits of banana material, combined with hand collection of beetles, has long been known in the control of *Cosmopolites sordidus*. Most accounts, however, are notably lacking in details of the methods and of the results to be expected from different field procedures. The following summary of baiting experience in north coast (N.S.W.) plantations may therefore be of interest. The field work on which it is based was done at intervals in the four years period 1933-37, and involved the cutting, placing and examination of over 5,000 baits. The plantations concerned were all of the Cavendish (dwarf) variety.

Material.—Well-grown banana pseudostems were the chief source of bait material. Each pseudostem was cut off at ground level and then sliced with a cane knife into cylindrical sections, $2\frac{1}{2}$ to 3 inches in thickness. From 10 to 14 of these bait slices can be cut from most pseudostems after allowing for waste. The baits varied widely in their relative content of rhizome and leaf-sheath tissue, depending on whether they were cut from the basal 6 inches of the pseudostem or from higher up. However, there were no indications that slices consisting wholly of rhizome tissue were more or less attractive than slices wholly or partly composed of leaf-sheath tissue.

The pseudostems used for bait were chiefly those from which the bunch had recently been harvested. In some of the work, however, fully-grown pseudostems which had not yet fruited were used to supplement the bait supply

Method. Each bait slice was placed flat on the ground, in the stool, and covered over with a quantity of dead banana leaf debris. After the required interval had elapsed, the baits were examined and the beetles gathered from the surface of the bait or the soil below it. Collection is easy and rapid, for *C. sordidus* is very sluggish and feigns death when disturbed. As regards the number of baits per stool, all numerical results in this paper were obtained using one bait per stool. In other work not dealt with here, 2, 3, or 4 baits were used simultaneously in each stool.

Position of Baits. Far better results were secured from baits placed within the stools than from those laid in the spaces between stools. The figures in Table A are typical of the disparity observed between inter-stool and intra-stool baits in the number of beetles caught. Table A gives the results in a one-tenth acre plot where baits were laid in both positions concurrently.

Period of Exposure. In the writer's earlier work, the baits were left in position for one day only. It was found, however, that a longer exposure (6 to 8 days) resulted in greatly increased numbers of beetles being taken at the end of the period. For instance, a block of bananas slightly over an acre in area was baited in 3 sections during February, 1934, giving the results

TABLE "A".

Performance of Baits in Different Positions.

Period of Exposure of Baits.	A. Baits in or beside the Stools.		B. Baits between the Stools.		Ratio of Beetles Caught per 30 Baits. A : B.
	Beetles.	Baits.	Beetles.	Baits.	
2/3 Mar., 1933	236	43	57	30	165 : 57 (2·9 : 1)
7/8 Apl., 1933	241	42	35	30	172 : 35 (4·9 : 1)
22/23 Mar., 1934	148	42	30	30	106 : 30 (3·5 : 1)
22/29 Mar., 1934	929	42	142	30	664 : 142 (4·7 : 1)

TABLE "B".

Long v. Short Exposure of Baits, 1934.

Section.	Stools.	Baits Exposed.	Total Beetles Taken.	Baits Exposed.	Total Beetles Taken.
A	166	5/6 Feb.	530	5/12 Feb.	1,285
B	121	7/8 Feb.	411	7/13 Feb.	1,205
C	166	9/10 Feb.	391	9/15 Feb.	1,414
Totals	453		1,332		3,904
Avge. beetles per stool			2·9		8·6

TABLE "C".

Long v. Short Exposure of Baits, 1934.

Section.	Stools.	Baits Exposed One Day.		Baits Exposed Six or Seven Days.	
		Total Beetles Taken.	Average per Stool.	Total Beetles Taken.	Average per Stool.
D	42	148	3·5	929	22·1
E	36	199	5·5	495	13·7
E	36	110	3·0	458	12·7

shown in Table B. Similarly, 2 smaller sections of the same plantation were baited early in 1934, and showed even more striking differences between the short and long exposures of the bait (see Table C).

In studying the counts for individual stools in the 1934 baiting, it was found that only 2 per cent. of the 453 baits yielded 10 beetles or more (one-day exposure). On the long exposure, however, 36 per cent. of all baits yielded 10 beetles or more.

Penetration of Beetles into Baits. Although high beetle numbers can be obtained by exposing the baits for 5, 6, 7 or 8 days, it is inadvisable to leave them in position for more than 8 days if hand collection of the beetles is to be carried out. The reason is that after the first week the beetles begin to mine into the tissue, penetrating deeply along the lacunæ so that rapid hand collection becomes impossible.

When baits were left in position for 2* and 3 weeks, it was found (i) that considerable beetle numbers were present at them, and (ii) that the majority of

* The baits left out for 2 weeks had been dusted with Paris green-flour, and they are the only poisoned baits referred to in this paper. The beetles embedded within them were alive. Forty of these baits were found to contain a total of 165 live beetles after 2 weeks' exposure. Some baits contained as many as 14 beetles.

these were deeply embedded within the bait. This result suggested a variation of the baiting method along the following lines:

Two or three weeks after baiting, the baits are lifted and any beetles at the surface are collected. As each bait is examined, it is thrown into a bag (with the beetles inside it) and removed from the plantation. As the bait slices undergo much shrinkage and loss of weight during the 3 weeks' exposure, this procedure is less laborious than would appear. This method would be of special use in protecting new plantings from beetles migrating from infested areas closely adjacent.

Season. Although beetles come freely to the baits in the months September to April inclusive, there is an almost complete avoidance of baits in the depth of winter, at least in the more inland districts. The figures in Table D are from a plantation at Leycester, west of Lismore, and indicate a sharp decline in beetle numbers at the baits during the period late May-late August.

TABLE "D".

Variation in Beetle Counts in the same plot through the Year.

i.	ii.	iii.	iv.	i.	ii.	iii.	iv.
Date.	Total Beetles Caught.	No. of Stools Baited.	Beetles per 50 Stools Computed from Cols. (ii) and (iii).	Date.	Total Beetles Caught.	No. of Stools Baited.	Beetles per 50 Stools Computed from Cols. (ii) and (iii).
2/3 Mar., 1933	264	50	264	17/23 Feb., 1934..	1,054	50	1,054
7/8 Apr., 1933	262	49	267	22/29 Mar., 1934	955	43	1,110
21/22 Aug., 1933	8	49	8	May 29 and May			
3/4 Sept., 1933	36	12	150	30 to June 6,			
22/23 Mar., 1934	148	43	172	1934 ..	101	35	144
29/30 May, 1934	12	23	26				
←Short Exposure→				←Long Exposure→			

There is reason to think that this winter dormancy period is shorter under the milder winter conditions of the seaboard districts. At Dunoon, which is nearer the coast than is Leycester, it was found in 1936 that beetles come fairly readily to the baits during April, May and the first half of June.

Percentage of Beetles Attracted to Baits. This value would naturally vary enormously under different conditions of weather and general environment of the beetles. The following instance, however, throws some light on the question.

In 1935, 16 stools in a plantation of negligible beetle population had been enclosed in plots of 4 by iron partitions in order to minimise migration between plots. Three long-exposure baitings during 1935 and January, 1936, yielded a total of only 5 beetles from the 16 stools (instead of the 400-600 beetles which would be expected from 16 heavily infested stools similarly baited). These 5 beetles were destroyed, and the stools were given a further baiting in February, 1936. As no beetles were taken in a 7-day exposure, the population of the 16

stools could be regarded as virtually nil. Two and a half weeks later, the stools were artificially infested with 40 beetles per stool in their natural sex ratio (total=640).

When baited $2\frac{1}{2}$-3 weeks later, using a 7-day exposure, a total of 109 beetles was recovered, averaging 6·8 beetles per stool. Now the adults of *C. sordidus* are extremely long-lived, and there was no evidence of any specific predators in this district. Therefore, it is fair to assume that the population of 40 beetles per stool had not declined appreciably by the time the baits were applied, so that the " yield " of 109 beetles can be regarded as approximately 17 per cent. of the total population of the stools.

A fuller account of this and other work on *C. sordidus* will appear as a science bulletin of the N.S.W. Department of Agriculture.

C. R. Wallace.

Entomology Branch,
Department of Agriculture,
Sydney.

COPPER BUNTICIDE STANDARDS.

Owing to the limited knowledge of the mode of action of copper bunticides, standards (both chemical and physical) must necessarily be formulated on empirical bases.

It is generally conceded that the copper ion is responsible for the poisoning of many spores, but whether it enters into solution from insoluble compounds by the agency of carbon dioxide and water, or through the agency of the spores themselves is still a matter of lively controversy.

The dusting copper bunticides on the market consist in the main of basic carbonates, basic sulphates, mixtures of these two, and oxychlorides. They are sold under proprietary names and as " copper carbonate ". Actually no such compound as normal copper carbonate is known to chemistry. Two basic carbonates are common minerals, whilst others have been prepared chemically. The latter rarely have the constancy of composition of the natural minerals.

To determine the relative efficiency of the dusting powders, resort must be made to field trials carried out over a period of years. Varying seasonal and soil factors are liable to influence results.

So far, it has not been found possible to correlate bunticidal activity with the chemical or physical properties of the dusts. It is known, however, that diluents which lower the copper content reduce the efficiency of " copper carbonate ". Contrary to expectations, some coarse-grained powders are more efficient than the fine-grained types. Some basic sulphates, and mixtures

of basic sulphate and basic carbonate, have been proved superior to the best basic carbonates in field trials with heavily smutted seed.

It is safe to say, from trials, that any copper bunticide containing a high percentage of copper, provided it dusts readily and covers the grain, will control bunt if the seed is not visibly tipped with spores.

The necessity for setting a standard for these materials is obvious. The users must be protected and the manufacturers encouraged to produce a high grade product at minimum cost.

A Standard Recommended for Australia.

W. R. Jewell and B. L. Southern, after considering data available from experimental work carried out in Victoria (Twentyman, 1931) and Western Australia (Southern, 1931) recommended to the conference of ministers for agriculture in 1934 the adoption of the following standards for Australia :

> Any copper compound or mixture containing copper sold for the dry control or prevention of any fungous disease of cereals shall conform to the following standards :
>
> (*a*) It shall contain not less than 50 per cent. copper (Cu) in the form of basic carbonate and/or basic sulphate or oxychloride. (*Note.*—The label, in addition to the percentage of copper, should state the form or forms of basic salt in which it occurs.)
>
> (*b*) It shall contain not more than one-quarter per centum of copper in a form soluble in water.
>
> (*c*) Not more than two and one-half per centum of the material shall be retained on a standard I.M.M. 200-mesh sieve when 10 grammes of the material are shaken by hand for five minutes with 150 ml. of water in a stoppered 500 ml. Erlenmeyer flask and sieved in a gentle stream of water poured from the flask or a wash-bottle.

It is interesting to note that recent American work has confirmed much of that done in Australia. Leukel (1937) found that the basic carbonates and basic sulphates, which contained 50 per cent. of copper and were of the proper degree of fineness, were among the most practical dust fungicides for bunt control on the market in the United States. It is necessary to use larger quantities of diluted dusts.

B. L. Southern.

Government Chemical Laboratory,
Perth.

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THE INJURY OF GRAPEVINES BY LIGHTNING STRIKE.

The significance of lightning storms in relation to disease in plants has been considered in a number of places. Sharples,[1] to take an example, finds " that lightning is a factor of the first importance in the causation of disease on coconut palm plantations in Malaya ". In temperate climates, such as that of South Australia, where lightning storms are relatively uncommon, the significance of lightning in the causation of disease may escape notice. The intention of this note, then, is to draw attention to what appears to have been a well-defined case of injury from lightning strike. Because of the nature of the phenomenon, the chance of directly observing lightning strike in a field of plants like grape vines does not often occur, and one must usually, as in the case to be described, fall back on indirect evidence.

In the present case, the affected vines (variety Grenache) were growing at Watervale, South Australia, and the attention of Mr. J. B. Harris, district horticultural adviser, was drawn to them by Mr. O. C. Sobels, who expressed the opinion that the vines had been struck by lightning. The affected plants were first noticed in December, 1937, about a fortnight after a spell of storms and lightning. According to the records of the Weather Bureau, kindly made available by the Divisional Office, a dry period at Watervale was terminated on November 28th by lightning and rain. Heavy rain fell subsequently and on each day till December 2nd, when further lightning occurred. During this period, 331 points of rain were recorded.

Mr. Harris and I saw the affected vines late in January. They occupied a roughly elliptical area with a long axis of about 50 feet. The long axis corresponded with the slope, which fell gently to the north-west. The affected patch of vines was about one-quarter of the way up the slope, and about 100 yards from a fence outside which there were a few scattered eucalyptus trees.

Symptoms.

Viewed as a whole, the most striking symptoms on the vines themselves were the defoliation, death and greyish discoloration of the tops of a large proportion of the vertically growing shoots. Lower down on these same shoots the normally green cortex was altered to a dark brown colour, while lower still this discoloration was confined to the internodal region.

The most severely affected vines (4-5 vines) occupied a strip in the centre of the area, but these vines had not been killed, for fresh shoots were growing from their bases. The vines at the edge of the affected area presented a striking appearance in that many of their shoots bore bright red leaves, such as this variety usually bears in autumn. Many of the stems also showed unusual symptoms. The cortical tissues, especially in the internodal region, were dead and splitting, and beneath these dead tissues, particularly beneath each node, abundant callus development occurred, giving the node the appearance of an

Shoot from Grape Vine struck by Lightning.
(Photo by A. D. Cocks.)

enlarged joint. This effect on the stem is illustrated in the accompanying photograph. On many leaves, a further feature was the browning in short sections of the veins. In a few cases, bunches of grapes were observed in which severe russetting occurred, the berries often being split and exposing the stone. There was no opportunity to examine the larger roots for evidence of lesions.

On the dead cortical tissues, numerous fungi had developed; among others a *Monochætia* and a *Macrophoma* were observed. On any one cane a particular form was predominant, but there was no consistency of development from cane to cane.

A search of the literature reveals that the subject of lightning injury to vines has received a good deal of attention. Among early work, that of Ráthay,[2] who paid special attention to the reddening of the foliage and described the attendant histological changes in the shoots, should be mentioned. More recently, and with a greater wealth of detail, Manzoni[3] has covered similar ground. His account of the changes confirms in essentials that of the earlier workers. In this note it is only necessary to add that the histological characters of the injured tissue as described by Ráthay were observed in the Watervale material, and for fuller details the reader should consult the papers cited.

There is one other point worth referring to, and that is the comparatively large area affected. The shape of this area and its relation to surface contours suggests that the heavy rainfall occurring about the time that the strike took place had some bearing on the size of the area affected. At the same time, reference should be made to a theory of lightning discharge utilised by Sharples[1] to account for the different sizes of lightning-struck areas in coconut palm plantations.

D. B. Adam.

Waite Agricultural Research Institute,
South Australia.

References.

[1] Sharples, A. 1933. Ann. Appl. Biol. 20: 1-21.
[2] Ráthay, E. 1891. Denkschr. d. Kais. Akad. d. Wissenschaft. Mathem.-Naturwiss. Klasse, 58: 585.
[3] Manzoni, L. 1934. Reprinted from Ann. R. Staz. Sper. di Vitic. e di Enol. di Conegliano, IV, 2-22.

The Australian Institute of Agricultural Science

SPECIAL NOTICE TO MEMBERS

SECOND GENERAL MEETING OF THE INSTITUTE

Notice is hereby given that the Second General Meeting of the Institute will be held at Canberra on the 9th and 10th January, 1939. This will immediately precede the Biennial Congress of the Australian and New Zealand Association for the Advancement of Science, to be held at the Federal Capital also.

The General Meeting of the Institute will be held at 2CA Broadcasting House, Civic, Canberra. Details of the business to be considered will be announced later.

A. J. Vasey,
Hon. Secretary.

MEETINGS OF COUNCIL.

JUNE MEETING.

The first meeting of Council, following acceptance of the new Constitution, was held in the School of Agriculture, Melbourne University, on June 29, at 7.45 p.m. The President, Professor S. M. Wadham, occupied the chair, and there was a full attendance of delegates and/or proxies. The President said :

" Gentlemen,—It gives me very great pleasure to welcome you as delegates or proxies for delegates to this, the first Council meeting since the acceptance of the new Constitution.

Before we address ourselves to any detailed business, there are certain matters in connection with general organisation on which I ask you to record decisions. Reference to the relevant Articles of Association will show that the main activities of the Council in connection with the election and appointment of officers are related to a general meeting.

We have been informed that as a result of representations made by our solicitors on our behalf, permission has been granted for the statutory general meeting following incorporation to be held when and where this Council decides. It is therefore suggested to you for submission to your principals that this meeting be held in Canberra on January 9 and 10, 1939.

Should you agree to this suggestion, it will be necessary to make certain appointments to carry on the business of the Institute until that time. Reference to Articles 40 and 41 will show that the names of the holders of the offices of President, Hon. Treasurer and Hon. Secretary are stated for 1937.

Under the circumstances, will you agree to the re-election of the same President for 1938 and the re-appointment of the Hon. Secretary and Hon. Treasurer for the same period ? Other appointments which have to be made, and which I suggest at the present time, are those required by Article 61, namely a Publications Committee. The present committee consists of the Editor of the Journal, Dr. H. J. Hynes, the Business Manager, Dr. N. S. Noble, and Dr. R. J. Noble. In reappointing this committee we shall also have to reappoint the two former to their respective offices.

In explanation of the submission of these recommendations without notice to your principals, I have to say that the facts regarding the procedure required have been obtained from our solicitors only very recently. For the purpose of this meeting, I ask you to agree to the appointments suggested, while these actions will, of course, be recorded in the minutes of the meeting for confirmation by your principals before we meet again."

The Council agreed to the recommendation that the next general meeting of the Institute should be held in Canberra on January 9 and 10, 1939. It further re-elected Professor S. M. Wadham as President for the year 1938, and re-appointed Mr. R. L. Twentyman as Hon. Treasurer, Mr. A. J. Vasey as Hon. Secretary, Dr. H. J. Hynes as Editor of the Journal, Dr. N. S. Noble as Business Manager, the latter two, with Dr. R. J. Noble, to constitute the Publications Committee.

The admission to membership of applicants whose names were circulated to Council members on the recent list was approved as follows : J. A. Beare (S.A.), A. B. Beck (W.A.), S. C. Close (S.A.), J. R. Goode (S.A.), C. G. Greenham (A.C.T.), F. V. Knapp (W.A.), C. F. H. Jenkins (W.A.), R. M. Moore (A.C.T.), L. J. Newman (W.A.), D. O. Norris (A.C.T.), M. V. O'Reilly (N.S.W.), J. C. Palmer (W.A.), F. N. Ratcliffe (A.C.T.), P. A. Reid (N.S.W.), R. D. Royce (W.A.), B. Williams (W.A.). K. Woodroffe (S.A.), R. L. Crocker (student member, *pro tem.*) (S.A.).

In view of the overwhelming majority in favour recorded at the recent ballot of members of the Institute, the Council had no hesitation in directing the secretary to instruct the Institute's solicitors to proceed at once with incorporation and registration. The registered office of the Institute is to be that of its auditors, Messrs. Cleveland, Son, and Hislop, 20 Queen Street, Melbourne.

The President drew the attention of the Council to the consideration which had been given to the status and remuneration of members of the profession in the current issue of the Journal. He put his view that the approach to this question should be on a strictly factual basis. He therefore wished to move that delegates be asked to institute enquiries in their various States as to the average wage at which young graduates commenced duty in the Public Service, and with commercial organisations. These, further, should be compared with the remuneration offered to young men in other professions and to men of similar age without university training, in commercial occupations. The enquiry should be on the same basis in all States. To sum up, it was an enquiry into " age-wage-levels, with and without training ". The rate of increase from this initial salary should also be recorded.

Members of Council were impressed by the necessity for this enquiry and later action by the Institute, and did not under-estimate the size of the task it was likely to be. After discussion Dr. Richardson (S.A.) seconded the President's motion for this initial action, and further said that he foresaw the appointment of a permanent standing committee of the Institute charged with this particular responsibility in future years. Mr. Gillespie (N.S.W) stressed the difficulty likely to be encountered in obtaining uniform data for all States. The President felt that a statement on the technique of the survey, which he would be prepared to write, would overcome this. The President's original motion was agreed to by the Council, who trusted that detailed comment would be received from principals before next meeting.

AUGUST MEETING.

The meeting was held in the School of Agriculture, Melbourne University, on August 4, at 8 p.m. The President, Professor Wadham, occupied the chair. Apology for absence was received from the Hon. Treasurer, Mr. R. L. Twentyman.

Instructions had been issued to the solicitors to proceed to incorporation. They had advised it would be necessary to have the Memorandum and Articles re-signed with witnesses to signatures on account of recent tightening up of procedure under the Victorian Companies Act. In reply to Dr. Richardson (S.A.), the Hon. Secretary said that the total cost of incorporation would be £38, of which the solicitor's fees would be £15 15s. Mr. Leeper (A.C.T.) raised the question of the necessity for re-registering an office address should the Institute change its auditors, and wished to know cost of any possible re-registration. The Hon. Secretary was directed to make this enquiry (later ascertained as 6s. per re-registration.—A.J.V.)

Mr. F. C. Henderson (N.S.W.) was admitted to corporate membership, Mr. K. Needham (W.A.) and Mr. P. R. Gorrie (W.A.) to student membership.

A letter was received from the Honorary General Secretary of the A. and N.Z.A.A.S., inviting the Council of the Institute to nominate three delegates to the Council of the Association for the Canberra meeting from January 11 to 18, 1939. The Council decided to nominate the Hon. Secretary, together with the nominees of the branches in the States most distant from Canberra.

A telegram (July 21) was received from the Hon. Secretary of N.S.W. Branch, seeking Council's permission under Article 29 to join with other professions in protesting against the terms of N.S.W. Medical Practitioners Bill, 1938, which restricted the title " Doctor " to medical graduates ; and a later letter giving further details of the Bill, and the result of the protest meeting ; Mr. G. de V. Davis to be speaker on behalf of the Institute on a deputation to the N.S.W. Minister of Health. The President and the Hon. Secretary informed the N.S.W. Branch that Council's approval for the proposed action might be anticipated. This advice the Council unanimously confirmed.

A letter was received from the Hon. Secretary, Victorian Branch, suggesting that the Institute provide the Branches with specially printed slips to facilitate collection of subscriptions by branch treasurers, and enclosing set-up for such slips. The Council directed that this suggestion, with sample slips, be circulated to the Branches for comment with view to decision at next Council meeting.

The financial statement disclosed a cash balance at bank of £137 10s. 10d. on August 4.

The Hon. Secretary drew the attention of Council to the successful innovation in the meetings of the Queensland Branch of Notes and Exhibits programmes. This the Council noted with great interest.

It was reported that the suggestion had been received from several Branches that the payment of the first subscription should be made on submission of the application for admittance to membership, and not when the application was approved by Council, as stated in the Hon. Secretary's memorandum on the use of the new forms. It was decided to adopt this suggestion, and in event of non-approval the subscription is to be returned to the applicant.

The matter of a regular day in each month for Council meetings was discussed. It was decided to hold the next meeting on Tuesday, September 13, and thereafter on the first Thursday in each month.

THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE.

Income and Expenditure Account for Year Ended 31st December, 1937.

1936 £ s. d.	EXPENDITURE.	£ s. d.	£ s. d.
108 15 10	To Cost of Journal		158 5 2
37 15 4	,, Printing and Stationery		5 18 3
—	,, Annual Meeting Expenses		33 11 3
0 10 6	,, Incidentals		4 7 0
5 5 0	,, Audit Fee		5 5 0
6 7 4	,, Petty Cash		3 14 1
	,, Grants to Branches:		
20 7 0	New South Wales	23 18 6	
17 17 6	Victoria	20 18 0	
13 9 6	South Australia	13 4 0	
10 3 6	Queensland	12 7 6	
12 13 0	West Australia	8 16 0	
6 12 0	Federal Capital Territory	7 19 6	
4 13 6	Tasmania	4 2 6	
			91 6 0
£244 10 0	,, Total Expenditure for Year		302 6 9
89 17 0	,, Surplus for Year		56 16 3
£334 7 0			£359 3 0

1936 £ s. d.	INCOME.	£ s. d.	£ s. d.
	By New South Wales Branch, Subscriptions—		
	1936	7 7 0	
77 19 0	1937	84 0 0	
			91 7 0
	,, Victorian Branch, Subscriptions—		
	1936	2 2 0	
70 15 0	1937	79 19 0	
			82 1 0
	,, South Australian Branch Subscriptions—		
	1936	2 7 0	
52 9 0	1937	49 6 0	
			51 13 0
38 17 0	,, Queensland Branch, Subscriptions 1937		48 10 0
51 6 0	,, West Australian Branch, Subscriptions 1937		35 12 0
	,, Federal Capital Territory Branch, Subscriptions—		
	1936	1 1 0	
25 4 0	1937	29 8 0	
			30 9 0
17 17 0	,, Tasmanian Branch, Subscriptions 1937		15 15 0
	,, Overseas, Subscriptions—		
	1936	0 10 0	
	1937	2 2 0	
			2 12 0
	,, Interest		1 4 0
£334 7 0			£359 3 0

Balance Sheet as at 31st December, 1937.

1936 £ s. d.	LIABILITIES.	£ s. d.	£ s. d.
	Sundry Creditors—		
82 18 6	Branch Grants	91 17 0	
36 7 10	General	14 7 0	
			106 4 0
2 2 0	Subscriptions Paid in Advance		1 1 0
	Accumulated Fund—Balance at 1/1/1937	193 16 0	
193 16 0	*Add* Surplus for year to 31/12/1937	56 16 3	
			250 12 3
£315 4 4			£357 17 3

1936 £ s. d.	ASSETS.	£ s. d.	£ s. d.
—	Office Furniture		6 10 0
	Cash at Bank—		
214 18 10	Melbourne	168 10 4	
3 2 6	Sydney	15 2 3	
			183 12 7
	Fixed Deposit	100 0 0	
	Fixed Deposit Accrued Interest	1 4 0	
			101 4 0
93 3 0	Subscriptions Outstanding (since collected)		63 5 0
4 0 0	Petty Cash on Hand		3 5 8
£315 4 4			£357 17 3

These are the Statements referred to in our Report dated 29th June, 1938.

CLEVELAND, SON & HISLOP,
Chartered Accountants (Aust.).

MEETINGS OF BRANCHES.

Canberra Branch, A.C.T.

Miss Lorna Byrne addressed the Branch on May 9, her subject being " Organisation for Agricultural Extension Work ". She gave interesting sidelights from her visit abroad of the methods adopted in various European countries and America for the dissemination of information on agricultural topics, and for fostering general culture amongst country people.

It was clear that Miss Byrne felt that the duties of an extension service should not be limited to giving scientific information, but should extend into the home and community life of country people and generally indicate the way to the larger life on the land. For such wide terms of reference, the extension service would have to be carefully chosen and well trained.

New South Wales Branch.

The eighteenth ordinary general meeting was held at Science House on June 17. There was an attendance of 42, including visitors. The main business was an address by Mr. A. R. Pursell, a brief account of which is included under " Current Notes and News ".

At the nineteenth meeting of the Branch on August 12, members were addressed by Professor R. D. Watt, the subject being " Agricultural Gleanings from a Recent Trip to the Home Countries ", a report of which appears elsewhere in this issue.

Victorian Branch.

The main business of the meeting held on July 15 was an address by Mr. H. A. Mullett on " Science and the Man on the Land ", a brief account of which appears under " Current Notes and News ".

At the meeting held on July 29, Mr. P. S. Lang discussed the work of the sub-committee appointed in June, 1937, to make preliminary investigations with regard to the survey of agricultural potentialities of Victoria. In 1937, a booklet of 24 maps of Victoria was published showing various forms of production on a county basis. These maps showed the distribution of acreage under wheat, oats and barley, and the number of sheep, dairy cattle and beef cattle by parishes. Mr. Lang indicated how it would be possible to link the production of each district with its controlling factors of climate and soil, and to determine where expansion of production would be practicable.

Following an interesting discussion, centred largely on the relation of markets to future production, the original sub-committee was asked to carry the investigation a stage further by making a detailed study of the agricultural potentialities of one or two parishes in an attempt to establish a working method for a similar survey of the rest of Victoria. The following estimated prices for various products were suggested : wheat, 3/6 per bushel at ports ; butter-fat, 1/- per lb. at factory ; ewe and lamb, £1 ; dry sheep, 8/- ; and a fat bullock, £12.

South Australian Branch.

The second meeting of the Branch for this year was held on June 23 in the lecture hall of the Ranson Mortlock Laboratory, Waite Research Institute. There was an attendance of 26 members. Under a regulation of the South Australian Branch, the Branch President becomes the delegate to the Federal Council, and Mr. W. J. Spafford was declared the Branch delegate for the current year.

Mr. H. R. Marston, Officer in Charge of the Animal Nutrition Laboratory of the C.S.I.R. at Adelaide, addressed the meeting on his impressions and experiences during a recent visit to Europe. A short account of this address is given under " Current Notes and News ".

Western Australian Branch.

The W.A. Branch recently collaborated with the State Committee of the C.S.I.R. in entertaining Dr. John Hammond at dinner, and in arranging a public lecture. Dr. Hammond spoke on the scientific aspects of animal nutrition and made particular reference to the applications to meat production.

Mr. H. A. J. Pittman, a past Branch President, was congratulated on his appointment as Principal of Dookie Agricultural College, Victoria. While wishing Mr. Pittman every success in his new sphere, members of the Branch very much regretted his departure from the State where he had laboured so successfully as Plant Pathologist in the Department of Agriculture for the past ten years.

Mr. G. H. Burvill returned from South Australia on May 6, having spent fourteen months in the Soils Division of the C.S.I.R. His work took him to Kerang and Mildura, Victoria, and to the Mt. Burr forests near Millicent, South Australia, as well as Adelaide. At the meeting held on June 3, Mr. Burvill spoke on this work, and alluded to the value of interchanges of officers between States and organisations.

Queensland Branch.

The meetings on May 27 and June 24 were held in the board room of the Department of Agriculture and Stock.

On May 27, Miss Barbara Shields read a paper on " The Development of Field Experimental Technique ". Opening with an outline of the systematic but unreplicated experiments fifty years ago, she indicated the more striking improvements which have since taken place, and pointed out that each followed a definite recognition of defects in the designs then available. After reviewing the contributions of Fisher, " Student " and Yates to modern statistical theories, type examples of factorial and pseudo-factorial designs, confounded and partially confounded layouts and split plot experiments were illustrated. The applicability of the various designs to experimental requirements in Queensland was then discussed.

The June meeting was devoted to exhibits, which are described under " Current Notes and News ".

Tasmanian Branch.

At the general meeting, it was decided that the Branch meet periodically for the purpose of discussing items of general interest, and that a paper be given, when possible, detailing features of research work and problems conducted by individual members or sections.

The first of these was held at Austin's Ferry on July 15, when Mr. R. A. Sherwin gave an interesting talk on the Ctessy Farm. The Tasmanian Department of Agriculture acquired this property for experimental purposes some eighteen months ago, and already rapid progress has been made. For the present, work is being concentrated on seed selection and the establishment of reliable and heavy cropping lines of wheat, oats and peas. The importation and testing of wheat varieties, with a view to producing a better quality flour, is also under way. Projected work on stock was briefly outlined.

Current Notes and News

Pasture Management.

At the May meeting of the Agricultural Sciences Club, Waite Research Institute, a paper was presented by Mr. J. R. Goode, on behalf of Dr. J. G. Davies and himself, on " Pasture Management ". This dealt chiefly with the scope and objectives of a comprehensive investigation at the Waite Institute to determine the influence of varying forms of pasture management on the persistence, seasonal and total yield of a seeded pasture, its botanical composition at set intervals, and the yield and composition of hay following various grazing treatments.

Mr. Goode said that, of all the environmental influences to which a pasture was exposed, none was more important than the effect of the grazing animal. This was, however, a somewhat recent concept. Considerable advances had been made in Australia in connection with the improvement of soil fertility levels, and the development of improved seeds mixtures, based on superior species and strains of herbage plants ; but the question of pasture management had received comparatively little attention. At the Waite Institute, a uniform stand of *Phalaris tuberosa*, Wimmera rye-grass and early flowering subterranean clover, covering an area of approximately eight acres, had been divided into 54 plots, each of one-seventh acre, on which 18 distinct types of pasture management had been imposed. Grazing frequencies in cycles of 3, 6 and 9 weeks, and grazing intensities of 2, 4 and 6 sheep per acre were employed in the nine possible combinations of treatment. These nine treatments were each imposed with and without cutting for hay, making 18 treatment combinations in all, with three replications of each treatment. The yields of the plots were obtained from sample cuts, and the sheep were weighed before and after each grazing interval.

The main results of the first year's work were demonstrated by means of tables and diagrams. The trial was designed to run for a period of years, and the present results merely indicated the trends along which the effects of treatment had so far proceeded. Already, however, distinct differences had become evident in the pasture as a result of variations in the type of management imposed ; and it was apparent that results of increasing value would be obtained as the period of the experiment lengthened.

Ecology of Plague Grasshopper in S.A.

At the July meeting of the Agricultural Sciences Club, Waite Institute, Mr. H. G. Andrewartha gave an address on this subject.

The Australian Plague Locust (*Chortoicetes terminifera*) has been found as a solitary grasshopper over a wide area in South Australia. The insects inhabit specialised ecological niches ; in the more arid districts, local areas which are more humid than the surrounding country provide favourable habitats. The absence of an organised drainage system, which is a characteristic of dry areas, influences the occurrence of these favourable habitats. They may be associated with such physical features as watercourse, " swamp ", depression, or flat. Favourable habitats may occur in any of the major vegetation zones of the semi-arid areas of South Australia ; they tend to be more frequent and more extensive in certain areas, notably in zones where *Hakea leucoptera* or *Acacia aneura* is a dominant. These local situations usually support a plant community of herbaceous perennials and ephemerals. The floristic composition may vary widely, but certain species occur so frequently that they are recognised as useful indicators ; several perennial species of *Eragrostis* are important.

An analysis of meteorological records provides an explanation for the plague of 1934-35. Between 1931 and 1933, several adequate falls of rain during the summer period enabled swarms to develop in the endemic areas. In 1934, abnormally dry autumn conditions in

the wheat belt enabled a further generation to develop in the areas of invasion. A return to more normal weather in 1935 destroyed the outbreak. The endemic areas for this locust in South Australia are so vast that control measures aimed at the prevention of swarms are impracticable. The present investigations should facilitate the anticipation of plagues, and thus provide time for the organisation of control measures in the more closely settled areas.

The Small Plague Grasshopper (*Austroicetes cruciata*) has a wide, but definitely restricted distribution in South Australia. It occurs in an area which corresponds fairly closely to a bioclimatic zone in which the P/E ratio exceeds 0·5 for not more than five, and not less than two months of the winter. Maximum development is reached where this condition prevails for about four months. Observations on the local distribution and abundance, and also on the tropisms associated with egg-laying, indicate that *Austroicetes cruciata* requires a highly specialised habitat. It is proposed to investigate the possibility of controlling this pest by modifying the environment. Either soil conditions or vegetation might be altered by artificial means.

Australian Butter in England.

On June 17, Mr. T. H. Atkinson of the Australian Sunny South Service Pty. Ltd., addressed a combined meeting of the Melbourne University Agricultural Society and the Victorian Branch of the Institute on " Australian Butter as I saw it in England ".

Of the 190,000 tons of butter manufactured annually in Australia, about 90,000 tons were exported, mainly to Great Britain, stated Mr. Atkinson. This export butter had to meet severe competition from many other countries on the world's market. Fortunately, Australia and New Zealand, being Southern Hemisphere countries, supplied their greatest volume during the period of low production of the northern countries which are very much closer to England. But for this, our lack of reasonable continuity of supply of butter to our export market would be a much more serious handicap.

The quality of Australian butter had undergone a marked improvement in the past few years, but so had all butter now entering England. There were, however, butters with different characteristics, notably Danish which was regularly fresh and of high lactic aroma and flavour. Best Australian butter opened up in excellent condition after a 12,000 miles voyage and cold storage covering a period very rarely less than two months.

Australian butter flavour was very mild compared with Danish, continued Mr. Atkinson. It was being accepted and preferred by an ever increasing number of consumers, and along with New Zealand butter had captured the principal butter trade of Southern England. One hundred per cent. efficiency could be attained by using only cream—(1) that was not more than two days old ; (2) that in which a small amount of natural or induced ripening had developed, not much exceeding 0·3% acidity ; and (3) that had a relationship between its fat and serum (plus necessary water added in processing) to give a fat content ranging between 33% and 38%, according to certain circumstances. The cream should be " neutralised " to between 0·05 and 0·1% acidity so that the degree of acidity remaining in the butter was between neutral and 0·01%. The temperature of pasteurisation of cream should be between 190 and 193 deg. F. The cream reduced to suitable churning temperature was churned to a fairly fine grain, mildly salted to between 1·25% and 1·35%, and was worked to very close plastic consistency. This latter point was most important, as it had a bearing on both keeping quality and spreadability.

There was room for a very great increase in consumption of butter in England at a price which was within the means of the average consumer. Increasing numbers of them fell back on margarine for their fat requirements whenever a temporary rise in butter price occurred. Concentration of manufacture in larger and more economic units, and collective

marketing, would help to increase the value of butter to the producer without affecting rate of consumption. (Attendance, 50.)

Rural Sociology.

Dr. J. H. Kolb, Professor of Rural Sociology, University of Wisconsin, addressed the Melbourne University Agricultural Society on June 24. In discussing the " Objectives and Methods in Rural Sociology ", Dr. Kolb explained that rural sociology dealt with all social and community relationships. The farm must be a place of continuous habitation. It was necessary to achieve a balance between the farm management or production and the standard of living or expenditure. Statistics had shown, stated Dr. Kolb, that the American city was incapable of perpetuating itself without a continuous inflow of citizens from rural areas. Consequently if the city was to be supplied from the country, then the city must take an interest in the education and growth of its future members, and rural sociology became of vital interest to urban populations. Another problem of population was the necessity for bringing back families which had settled in marginal areas under artificial conditions. Concluding, Dr. Kolb considered that land had been carrying a disproportionately large share of the taxation burden. (Attendance, 56.)

Co-operative Irrigation and Fodder Conservation.

In an address to the N.S.W. Branch of the Institute in June, on " Co-operative Irrigation and Fodder Conservation at Menindie ", Mr. A. R. Pursell first emphasised the effects of drought on the prosperity of the State, the loss in income from wool alone for the period 1920-1935 being estimated at £67 million. This loss may be greatly decreased by fodder conservation, but it is essential that there should be some cheap source of fodder. The speaker then outlined the results of his investigations into the possibilities of utilising the dry lakes at Menindie as a vast irrigated area for the purpose of fodder conservation. It was claimed that an efficient co-operative organisation could produce on this area large quantities of fodder at a price far below existing rates. The plan provides for a weir at the mouth of Lake Menindie at a rather low capital outlay. It was estimated that the water conserved by this initial scheme would total almost one million acre feet, making possible the irrigation of some 62,000 acres of Lakes Menindie and Cawndilla. The lakes are naturally drained, very fertile, free of any troublesome timber, and in all permit of large scale irrigation at low cost.

In tentatively allocating proportionate acreage to lucerne, pastures, corn, rotation, dairying, growth of seed, drainage areas, yards, roads, channels and scoured lands adjoining irrigation drains, Mr. Pursell likened the entire project to a large-scale farm. It was estimated the total hay production would amount to 200,000 tons, that the stubble would play a large part in carrying 130,000 sheep ; wool production would be over 1,000,000 lbs. ; lamb production 100,000, and milk production almost 2¾ million gallons from 5,000 cows at a cow per acre of the area allotted to dairying. Valuing annual production (excluding hay) at almost £250,000 and total annual expenditure at approximately £285,000, the cost of producing the 200,000 tons of hay for fodder conservation purposes would represent the difference, some £40,000 or 4/- per ton. As secondary benefits of the scheme, Mr. Pursell mentioned the diversion of river water down the Lower Ana branch, the supply of water to Broken Hill, flooding of hundreds of thousands of acres of dry country, extended navigation up the river as weirs are constructed, and the practicability of irrigating lake areas on the eastern side of the Darling.

In a supplementary illustrated lecture, Mr. N. H. Parbery, Soil Chemist, described the physical and chemical characters of the soils in the areas under consideration. He emphasised the self-granulating nature of the clays, and the asset which this would prove

in grading operations. By contrasting the soil analyses with those of coastal soils, he also emphasised their calcareous nature and high fertility. The relative absence of undesirable soil salts was a noteworthy feature.

Co-operation in Animal Nutrition and Agrostology.

During the course of his address to the South Australian Branch of the Institute, Mr. H. R. Marston, Officer-in-Charge of the C.S.I.R. Animal Nutrition Laboratory, Adelaide, stressed the necessity for a closer liaison between the agrostologist and the worker on animal nutritional problems. Much progress had been achieved in the improvement of pastures by top-dressing, re-seeding and advanced types of pasture management, but the precise effects of these modifications, on the animals supported by the pasture, were not always clear. The daily food supply of the grazing animal, moreover, was not necessarily the same as the herbage from which choice could daily be made. The ultimate purpose in growing pasture was to obtain certain animal products of commercial value ; and it was only by the closest possible co-operation of workers in the two fields indicated that a solution of the complex problems involved could be secured. The association of the agrostologist with the research worker in animal nutrition, as part of the investigations relating to " coast disease " at Robe, South Australia, was an excellent example of the advantages to be derived from such a contact. Mr. Marston also referred to recent developments with which he had come in contact during his recent trip abroad.

Plantation versus Peasant Agriculture.

Mr. C. H. Burgess, a Melbourne graduate, and at present Agricultural Officer of the Department of Agriculture, Malaya, addressed the M.U.A.S. last May on " Some Observations on Agriculture in the Tropics ". After briefly outlining the change in attitude of the Home government to colonies, from the old colonial policy under which colonies were administered to the advantage and aggrandizement of the mother country to the present outlook which holds that a colony should, as far as possible, be developed to the benefit of the colony itself and to the welfare of the indigenous inhabitants, the speaker showed the effects of these policies on the development of agriculture. He indicated that it was inevitable that the older policy should lead to estate (or plantation) agriculture as typified by the West Indies, which were developed under the old colonial policy, and that under the new system peasant agriculture was fostered, as for example the West African colonies where native holdings only are to be found. In Malaya, the aim has been to strike a happy balance between plantation and peasant agriculture.

Plantation agriculture, continued Mr. Bugress, is undoubtedly more efficient and better organised, and the standard of agriculture and the quality of the produce is higher but there may be serious racial problems. Although relations between the three major races in Malaya—Malays, Chinese and Tamil Indians—are harmonious, it is likely that the influence of the numerically strong Chinese will be evident in the near future. Peasant agriculture, on the other hand, while less efficient and on a lower plane of production, gives a greater stability, contentment and self-sufficiency to a colony, especially if the raising of food crops is made a cardinal point.

The Talking Film in Agricultural Extension.

On July 15, the Victorian Branch of the Institute was addressed by Mr. H. A. Mullett, Director of Agriculture, on " Science and the Man on the Land ". Invitations were issued to leading agricultural and educational organisations and to the senior members of allied State departments. The attendance was 215. The address marked the inauguration by the Victorian Department of Agriculture of the talking film as a means of carrying out extension work. The film, which was prepared by officers of the Department, dealt with

wheat breeding, milling and baking qualities of wheat, seed testing and certification, dairy technology and many other activities of the Department.

Introducing the picture, Mr. Mullett stated that this means of instruction was likely to be singularly effective and capable of considerable expansion with experience. The aim was to reduce the time lag between scientific discoveries and their application by the producers. Illustrating this, Mr. Mullett said that although the economic benefit of top-dressing pastures with superphosphate had been demonstrated at Rothamsted in 1856, it was not until 1912 that it was applied in Victoria. In that year, it was proved at Rutherglen that the application of ½ cwt. superphosphate per acre converted pasture capable of growing wool only into pasture that would raise fat lambs. Yet ten years later (1922) only 1,000,000 acres of pasture in Victoria were topdressed. Since then the momentum has increased until now 4,000,000 acres are topdressed, but the State offered scope for additional large increases. By field instruction and pictorial demonstrations, agricultural improvements would be speeded up considerably, added Mr. Mullett. It was the intention of the Department to make closer contact with the producers by resident or district instructors.

A Meeting Devoted to Exhibits.

The meeting of the Queensland Branch of the Institute, held on June 24, was devoted to a series of exhibits :

(*a*) An improved soap for use in the preparation of resin-soda-fish oil as a spray. Present methods of preparing this general purpose insecticide are cumbersome, and the elaboration of a suitable soap should lead to more extensive usage than at present. Field tests of the spray prepared from the soap are projected, to compare it with similar sprays at present in use. (Mr. J. A. Weddell.)

(*b*) Mounted specimens of pest rats in canefields to illustrate the ecological work of Mr. A. McDougal on the subject. Thallium-impregnated wheat contained in waterproof packets is largely utilised at present for control purposes. The efficiency of this and other methods of controlling rats was discussed in the light of recent ecological and rat population studies. (A. F. Bell.)

(*c*) Pineapples affected with " marbling ", a disease which causes spoilage in canning products. Field infection is attributed to various bacteria, and the results of laboratory and field inoculation were discussed. (E. W. B. Da Costa.)

(*d*) Photographs illustrating experimental tests of a reputedly blue mould resistant variety of tobacco. (L. F. Mandelson.)

(*e*) Mounted specimens of sedges in the genus *Cyperus*, including *C. rotundus*, which is widely spread through coastal Queensland ; *C. bibax*, of some importance as a fodder in the far west ; and *C. victoriensis*, possessing some fodder value in the west and also important as a soil binder. The necessity for correct identification of grasses and sedges in pastoral research work was stressed. (S. T. Blake.)

A 25th Anniversary.

The Biological Branch of the N.S.W. Department of Agriculture was formed on July 1, 1913, and thus celebrated its 25th anniversary this year. The original staff comprised the Biologist (G. P. Darnell-Smith), Assistant Biologist (E. McKinnon), and Laboratory Assistants (W. A. Birmingham and S. Birrell), the activities being centred upon plant disease investigations and the elucidation of bacteriological problems in the dairy manufacturing industries. The first plant pathologist to be officially appointed in New South Wales, however, was Dr. N. A. Cobb, whose gazettal dated from April 1, 1890, but subsequently the State's plant pathological work was conducted by the Bureau of Microbiology, which was set up in July, 1908, as a separate branch of the Chief Secretary's Department, and whose main function was to deal with matters affecting health in human

beings and animals. In 1913, the agricultural work of the Bureau was transferred to the Department of Agriculture.

In its first year, the Biological Branch examined and reported upon 481 plant disease specimens, and distributed 102 lactic starters for purposes of cheese manufacture. For the twelve months ending June, 1938, the number of specimens examined in both sections of the Branch totalled 1,670, while the number of cultures (lactic, wine, legume, mushroom) dispatched to producers approximated 1,200. This provides but a small indication of the Branch's work, for investigation and extension occupy the greater portion of each officer's time. The contributions of the staff toward solution of problems affecting the primary industries are published periodically in various agricultural and research journals, and as science bulletins issued by the Department. A series of leaflets for farmers' guidance has been in operation for many years.

The present staff of the Biological Branch comprises eight plant pathologists, three dairy bacteriologists, two laboratory assistants and a glasshouse assistant.

The "Australian Journal of Science".

The first issue of the "Australian Journal of Science", published bi-monthly by the Australian National Research Council, appeared last month. The issue contains 32 pages of reading matter, and "Australian Science Abstracts" is included as a supplement. The articles are for the most part brief, and cover a wide field: Biology in Australian Education, Antarctic Research, Biological Survey of Tasmania, Work of the Great Barrier Reef Committee, Avifaunal Problems, Desiccation in Australia, Scientific Expedition to Moreton Bay, Social Relations of Science. Brief notes on current happenings in science in Australia are also a feature.

The journal is conducted by an editorial committee, of which Dr. A. B. Walkom is the chairman, and there are editorial representatives in each State. The annual subscription is 12/- (post free), which may be forwarded to the Editor, Science House, Gloucester St., Sydney.

Title of "Doctor".

Certain features of the N.S.W. Medical Practitioners Bill seeming to contain undesirable possibilities, the chairman of the New South Wales Branch of the Australian Institution of Engineers, Mr. L. H. Nutter, invited the professional and scientific bodies of New South Wales to attend a meeting at Science House, Sydney. In addition to the engineers, representatives attended the meeting from the Royal Society, Linnean Society, Institute of Architects, Veterinary Association and Institute of Agricultural Science. A series of meetings then took place, and the A.I.A.S. was represented at various times by Messrs. H. Parry Brown, G. de V. Davis and L. S. Cayzer.

Designed, in general, to control all branches of medical activity, and in one particular, to prevent any form of pseudo-medical charlatanism, the Bill, perhaps in all innocence, gave rise to some alarm through a meaning implicit in clause 42, the offending portion of which contained, *inter alia*, the following words:

> "Any person, not registered under this Act, who . . . uses any . . . title . . . which . . . alone . . . is capable of being understood to indicate . . . that he possesses a degree . . . which would entitle him to be registered as a medical practitioner . . . shall be guilty of an offence . . ."

These words, extracted from their context, would be capable of meaning that the mere fact of a science doctor, for example, using his title in the telephone book, and any member of the public thereafter believing that he was a medical doctor, would render the "doctor" concerned liable to prosecution. In particular, it was mentioned that many doctors in the agricultural profession receive medical advertisements and samples through the post; this fact rendered them liable.

After discussion, it was decided to ask the Minister for Health to meet a deputation which would put before him the feeling of the professional bodies represented. Professor A. S. Hook and Mr. G. de V. Davis were appointed to the deputation, with Dr. A. B. Walkom as an emergency speaker. In due course, the Minister replied, stating that, after receiving the representations of the meeting, he had consulted his draftsmen and was willing to amend the clause in such a way as to safeguard the rights of men upon whom the title of doctor had been conferred by a recognised university. It has been disclosed, unofficially, that the amendment will enact that the circumstances under which the title " doctor " is used will be taken more definitely into consideration than was the case in the former draft of the clause. In other words, this means that for a man to be liable to conviction it would have to be proved that he had used the title in a way calculated to deceive the public and to give rise to the belief that he was entitled to registration as a medical practitioner. In general, it can be held that the purpose of the meeting was achieved, and that the rights and privileges conferred by a university upon a man highly qualified in any profession, not necessarily medicine, have been safeguarded.

Book Reviews

DAIRY CATTLE FEEDING AND MANAGEMENT, 3rd Ed., by H. O. Henderson, M.S.A., Ph.D.

(Pp. xxvi+557, with 93 tables, 108 figures and appendix. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1938. Price, 20/- net.)

This book is written primarily for students of agricultural colleges, and the authors presuppose knowledge equivalent to the " Intermediate " standard.

As indicated in the preface, much advance has been made in nutrition, pathology, genetics and economics during the last ten years (i.e. since the publication of the 2nd edition). Of these four, the authors deal thoroughly with nutrition through physiology, feeds and feeding, and advisedly less so with the other three. The lesson on metabolism is clear, sound and attractive ; that on milk secretion and the development of the mammary gland is well set out and is abreast of modern knowledge. The lesson on " Selection of Feeds ", interesting as it is, is for American consumption.

In summing up " the desirable characteristics of a ration ", the authors lead one into new avenues of thought and the chart indicating the complete cycle (nutrients—plants—animals—nutrients) is well thought out and pleasingly presented. Towards the end of the lesson a short terse remark sums up the advice given : " Let the cow's digestive system always feel that it is early summer ".

The advice on the essential nutrients of a ration is standard, but so much has been written about vitamins that it is quite refreshing to note the sound common sense way in which the authors have kept them in proper perspective.

The position with respect to feeding standards is well expounded and in sufficient detail to enable the student to utilise each system with the aid of Morrison's tables in the appendix. These tables now give the net energy of the foodstuffs in therms, which enable the ration compiler to compare his results with English standards.

With respect to pathology, one feels the less said the better in a book of limited space dealing with normal, healthy dairy stock, and one does not feel that the necessarily abbreviated chapter on " Common Diseases of Dairy Animals " improves this book.

The subject of genetics has moved apace, and the lesson on " The Principles of Dairy Cattle Breeding " attempts too much and suffers in consequence.

Australian farmers will appreciate the book ; the lessons on " Dairy Cattle Management ", " Feeding and Care of the Sire " and " Fitting Dairy Animals for Show " are highly commendable, and the lesson on " Calf Raising " is probably the most comprehensive that so far has been published.

In spite of criticisms, the book is well worthy of study : the subject work is well set out, the sequence holds one's attention, the multiplicity of helpful tables is a feature, and the many references and the appendix will be definite, practical helps to those undertaking a course of work on dairy husbandry.

F. WHITEHOUSE.

THE QUEENSLAND AGRICULTURAL AND PASTORAL HANDBOOK, VOL. III.

Part I. Insect Pests and their Control, by Robert Veitch, B.Sc.Agr., B.Sc.For., F.R.E.S.

Part II. Plant Diseases and their Control, by J. H. Simmonds, M.Sc.

(Pp. vii+254, in two parts, with 78 plates and 6 tables. Govt. Printer, Brisbane, 1938.)

Part I.

The writer of Part I of Volume III of the Handbook is Director of Plant Industry (Research) ; for about fourteen years he held the appointment of Chief Entomologist of the Division of Entomology and Plant Pathology. Mr. Veitch, therefore, has had a wide experience of the insect pests of Queensland, about which he can speak with authority ; he published a useful account of the pests of Queensland fruit and vegetables in 1929.

The opening chapter of the present work gives a brief account of various insecticides. The remaining four chapters deal with about 100 common economic insects occurring in Queensland. They are arranged in four groups : Fruit Pests (Chap. II), Agricultural and Grassland Pests (Chap. III), Vegetable Pests (Chap. IV), General and Household Pests (Chap. V) ; the pests of sugar cane are not included. In general, a short description of each insect and an account of its life history is given, together with information about control methods. A series of thirty splendid plates of drawings by I. W. Helmsing, illustrating the essential features of a number of the insects, forms a valuable part of the work. The information about the insects is given in non-technical language, and the work will prove useful to the practical farmer, horticulturist and fruit grower, as well as to students taking courses in agriculture.

J. DAVIDSON.

Part II.

The treatment in this Part follows the same plan as that adopted in Part I. The common plant diseases of Queensland are dealt with in terms of the crops they affect.

Fulfilling the objective of providing a guide for practical men, the author describes amply the principal symptoms of the diseases he deals with, and supplements these descriptions with an excellent series of illustrative plates, 48 in all. Descriptive detail about the causal agencies is carefully curtailed, but the information given will help the grower to see the reasons for the control measures he is asked to apply.

The discussion of control measures is unusually full and clear. The last chapter is devoted to details concerning the preparation of fungicides, and this feature—together with the details given under each disease—will appeal to all growers for whom, of course, the satisfactory control of disease is of paramount importance.

Although written primarily for the information of Queensland growers, this part of the handbook will have a wider appeal for at least two reasons. Firstly, for the information about control measures that it contains, and secondly, because the list of diseases dealt with and the emphasis placed on each provide a good picture of the plant disease situation in Queensland among crops other than sugar cane.

D. B. ADAM.

THREE THOUSAND MYCOLOGICAL TERMS, by Walter H. Snell.

(Pp. 151, with 12 plates. Providence, R.I., U.S.A. Publication No. 2 of the Rhode Island Botanical Club, 1936.)

Mycologists, plant pathologists and all students of botanical science will find this volume a most useful addition to their works of reference. As the name indicates, the book provides in glossary form the meaning of most terms encountered in mycological literature, and the clarity and simplicity of the definitions are notable features of the presentation. The fact that this work is a development from the mimeographed glossary prepared for junior and advanced students in mycology at Brown University, and has been supplemented with other terms obtained from scientific periodicals and suggested by various co-workers, renders it all the more comprehensive.

The series of plates included in the final pages of the book should prove very helpful to students generally in becoming acquainted with the significance of terms commonly employed in describing the fructifications and spores of the fungi.

H.J.H.

THE HORTICULTURAL NOTE BOOK, by J. C. Newsham, F.R.H.S.

(Fifth Impression. Pp. xx+418, with 113 figures and numerous tables. London: The Technical Press, Ltd. 1937. Price, 7/6 net.)

This is essentially a compilation of data and information, in condensed form, conveniently arranged as a reference book for horticultural students, nurserymen and others. It covers a very wide field, and the greater portion of the information is presented in tabular form, so that for complete details on several of the aspects readers will need to consult other works. But as a convenient and concise summary of data for everyday use in practical horticulture, the book has a definite place.

Chapters are devoted to weights and measures; land measuring and mensuration; garden formation and construction of drives, walks, lawns and sports fields; horticultural buildings (glasshouses, heating apparatus, cements, pumps); details of different types of hedges, fences, gates; geological formations and soils; chemistry of manures and fertilisers; plant propagation; fruit growing (culture, judging, pest and disease control, pruning, packing); floriculture; vegetable culture; trees and shrubs; insecticides and fungicides; garden meteorology; garden recipes.

H.J.H.

Personal Notes

New South Wales.

Professor S. M. Wadham recently visited Sydney to attend the final meeting of the Advisory Council on Nutrition. During his stay, the Executive of the N.S.W. Branch of the Institute arranged an informal dinner with him to discuss Institute affairs.

Mr. W. B. Tart, who, since graduation in 1932, has been on the agricultural staff of " The Sydney Morning Herald ", has been appointed Press Relations Officer to the Defence Department.

Mr. H. A. J. Pittman has been appointed Principal of Dookie Agricultural College, Victoria. Graduating B.Sc.Agr. with honours at Sydney in 1926, he was appointed to the staff of Yanco Agricultural High School. He later joined the C.S.I.R., spending some time at the Waite Institute, and from there was appointed Plant Pathologist in the Department of Agriculture of Western Australia. In 1934 he secured the B.A. degree and Diploma of Education in the University of Western Australia.

Mr. E. T. Edwards recently passed his preliminary examination for the Ph.D. degree at the University of Wisconsin. During the summer vacation he is making an extensive tour of U.S.A. and Canada, visiting universities, experimental stations and commercial seed companies. While in Utah, he will report on the " Witches Broom " situation there at the request of Dr. Westover, Senior Agronomist in charge of alfalfa investigations for the U.S.D.A.

Mr. W. I. M. Holman, Pawlett Scholar, has been awarded the Ph.D. degree at London University for research work in soil chemistry. Dr. Holman will remain in London, but Mr. Vincent, the other Pawlett Scholar, is now returning to Australia via U.S.A.

Victoria.

A very successful conference of entomologists was held in Melbourne recently, when research on grasshopper outbreaks was discussed. The following were in attendance: Prof. J. Davidson, Drs. I. M. Mackerras, K. H. L. Key and Messrs. W. B. Gurney, A. L. Tonnior, T. McCarthy, J. H. Smith, J. W. Evans, H. G. Andrewartha, J. Brake, S. Fish and R. T. M. Pescott. Opportunity was also taken by the State entomologists to discuss fruit flies and their effect on fruit export.

Mr. C. E. Cole has been appointed Horticultural Research Officer in the State Department.

Mr. J. E. Thomas resigned recently, after eight years' service at the Commonwealth Research Station, Merbein. He has taken over a pharmacy business in Melbourne, and proposes to study for a medical degree.

Mr. E. C. Orton has been appointed Senior Research Officer at the Merbein Station, while Mr. P. Dixon has been appointed Assistant Research Officer.

Miss Joan Hearman has been appointed Plant Physiologist, to study physiological problems in connection with citrus trees and vines under irrigation.

South Australia.

Mr. E. A. Cornish returned to Adelaide on August 13 after spending approximately twelve months abroad, studying modern statistical methods under Professor R. A. Fisher at the University of London.

Mr. J. S. Hosking has been granted twelve months' study leave by the C.S.I.R., and left Adelaide on July 16. He expects to spend the first few months at the University of California.

Mr. J. C. M. Fornachon has been granted a studentship by the C.S.I.R., and left for California on August 15. He expects to be away from Australia for two years and will visit England, France and South Africa during that period.

Other States.

A conference of experts on tobacco problems was held at Canberra in July. Dr. B. T. Dickson occupied the chair, and representatives from all States were present.

Mr. R. V. Fyfe, of Canberra, has qualified for admission to the M.Sc.Agr. degree, Sydney, his thesis dealing with an entomological subject.

Dr. I. M. Mackerras and Mr. T. G. Campbell, of Canberra, have both passed their flying test for the " A " pilot's licence.

Dr. W. Carter, of the Pineapple Experiment Station, Hawaii, and Prof. E. A. Ross, of Wisconsin, recently visited Queensland.

Special courses in horticultural subjects are included in the curriculum for agricultural students at Queensland University during this year. The lecturers are: Mr. H. K. Lewcock (pineapple culture), Mr. L. A. Thomas (deciduous fruits), and Mr. W. A. T. Summerville (tropical fruits other than pineapples).